ENGINEERS
AUSTRALIA

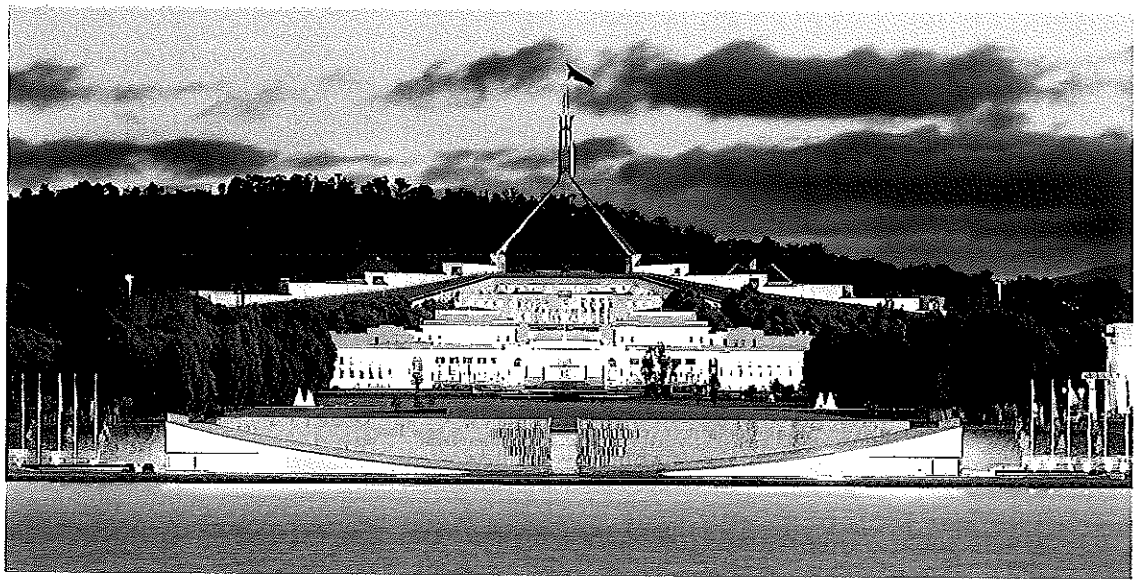
Canberra Division

NOMINATION OF

THE PARLIAMENT HOUSES OF CANBERRA

FOR AN AWARD UNDER THE

ENGINEERING HERITAGE RECOGNITION PROGRAM



BY
ENGINEERING HERITAGE CANBERRA

June 2013

HERITAGE AWARD NOMINATION FORM

The Administrator
Engineering Heritage Australia
Engineers Australia
Engineering House
11 National Circuit
BARTON ACT 2600

Name of works: The Parliament Houses of Canberra

These works are nominated for an award under the Heritage Recognition Program of Engineers Australia.

Location: In Canberra in the Australian Capital Territory (ACT).

OPH: In the Parliamentary Triangle in Parliament Square, facing King George Terrace with Queen Victoria Terrace at the rear.

NPH: At the head of the Parliament Triangle on Capital Hill bounded by Capital Circuit.

Owner: Commonwealth Government of Australia, CANBERRA.

The owners have been advised of this nomination and copies of the letters of agreement are at Attachments A1 and A2.

Access to site: Both Parliament Houses are open to the public during prescribed hours.

Nominating body: Engineering Heritage Canberra
Canberra Division, Engineers Australia
Engineering House
11 National Circuit
BARTON ACT 2600

.....
Robert Breen
Secretary
Engineering Heritage Canberra
19 June 2013

.....
Lyndon Tilbrook
Chair
Engineering Heritage Canberra
19 June 2013

1. BASIC DATA

Item Name

The Parliament Houses of Canberra:
Old Parliament House (OPH)
Parliament House (NPH)

Other/Former Names

OPH Executive Agency of the Department of Prime Minister and Cabinet, Museum of Australian Democracy at Old Parliament House.

NPH New Parliament House.

Location

In Canberra in the Australian Capital Territory (ACT).

OPH In the Parliamentary Triangle in Parliament Square facing King George Terrace with Queen Victoria Terrace at the rear.

NPH At the top of the Parliamentary Triangle on Capital Hill and bounded by Capital Circuit.

See Attachment B - Map 51 of Gregory's Canberra Street Directory.

Address

OPH 18 King George Terrace
Parkes ACT 2600.

NPH Parliament Drive, Canberra, ACT, 2600.

Suburb/Nearest Town

OPH Parkes.

NPH Parkes, Barton, Forrest, Deakin, Yarralumla.

State/Territory

Australian Capital Territory.

Local Government Area

The Government of the ACT.

Owner

The Commonwealth of Australia.

Current Use

OPH Museum of Australian Democracy at Old Parliament House.

NPH Parliament House of Australia.

Former Use

OPH Parliament House of Australia (1927 – 1988), Executive Agency of the Department of Prime Minister and Cabinet (1992 – 2009).

NPH Nil.

Designer

OPH John Smith Murdoch, Chief Architect, Department of Home Affairs.

NPH Mitchell/Giurgola and Thorp (New York).

Maker/Builder

OPH Department of Home Affairs/Federal Capital Commission.

NPH Parliament House Construction Authority (PHCA) in liaison with the National Capital Development Commission (NCDC) and the Department of Housing and Construction (DH&C).

	Year Started:	**Year Completed:**
OPH	1923	1927
NPH	1978	1988

Physical Description

OPH

Old Parliament House is located in Parliament Square across Griffin's land axis, some 750 metres from the southern shore of Lake Burley Griffin. Although ornate by present standards it was regarded as Stripped Classical design at the time and built on economic lines appropriate to its role as a provisional structure. It is constructed from Canberra red bricks with a white cement rendered exterior, and timber and lightweight concrete floors. The roofs are constructed of flat concrete slabs with a membrane waterproofing and finished with a bituminous coating which was designed to be walked on. The roofs have since been extensively modified in order to further waterproof the building.

Timbers from various parts of Australia are used in the interior design and extensive

use is made of natural light from windows, skylights, courtyards and light-wells. The original building was in two main blocks with the front for Parliament and administration and the rear for refectory and recreational rooms for members. Originally there was provision for 56 senators and 112 representatives although there were only 36 and 75 at the time. Besides the two main chambers (Senate and House of Representatives) separated by Kings Hall, a library, recreational facilities, party rooms, dining facilities, offices and press accommodation were included. Over the years of its use the building was expanded and modified to accommodate increasing numbers of members and their supporting staff. When decommissioned, some of the external extensions were removed. See Attachment C for more detailed information on the building.

NPH

New Parliament House is situated on Capital Hill also on the land axis of the Griffin design. The two chambers (House of Representatives and the Senate) are located symmetrically on either side of the land axis on a cross axis through the central hall. Support areas and offices are positioned around each of the chambers. Ceremonial, public, common areas and committee rooms are located along the land axis. The plan effectively devolved into three logical zones, the Central Zone along the land axis, the House of Representatives Zone to the east and The Senate Zone to the west. Reinforced concrete is the main structural material. The complex is surmounted by a stainless steel flagmast with four supporting legs and the central spine is covered with soil which has lawn-watered grass. This gives the structure the appearance of being situated in the hill rather than on it. See Attachment D for more detailed descriptions of the building and Attachment E for construction information.

Physical Condition

OPH Very good, well maintained and currently in use.

NPH Excellent, as would be expected for the Capital's premier building.

Modifications and Dates

OPH

Over the years there have been many modifications to Old Parliament House, which can be divided into two categories: building structure and engineering equipment and fittings. The modifications to the structure consisted primarily of extensions to accommodate more people – senators, members and supporting staff. The 1927 building was modified and extended in 1938-39, 1943-44, 1948-49, 1958, 1965 and 1972-74. As would be expected some of the engineering installations have been updated or replaced over the 61 years of its use. Information on these changes can be found in Reference 1.

NPH

Modification of NPH since its construction include:

- Changes to the flagmast flag control system early in its operation.
- Provision of additional service and storage spaces in the basement areas.
- Fitout changes to various areas including members dining, main committee rooms, main kitchen, reception hall lighting and Prime Minister's suite.
- Installation of stanchions in front of building to prevent "ram raiding" by 4WD vehicles driven by disillusioned citizens.
- Installation of security equipment following the 9/11 raids.
- Changes to mechanical and electrical services for improved energy efficiency including the addition of photovoltaic panels to supplement power and offset costs.

Historical Notes

OPH

The choice of Canberra as the Australian Federal seat of Government inevitably led to the need to construct a Parliament House. In 1912, the year before the formal naming of Canberra, King O'Malley, Minister for Home Affairs, initiated plans to conduct a competition for its design. Walter Burley Griffin assumed this task after his appointment as Director of Design and Construction in 1913. Competition conditions were issued in July 1914 but the then Minister for Home Affairs W O Archibald, withdrew them because of the outbreak of the First World War. In 1916 on the suggestion of Griffin, O'Malley, who was by then back in office, re-announced the competition. However in November 1916 another change of government led to the indefinite postponement of the competition. Subsequently, 78 of the 215 registered competitors were compensated for work so far performed.

By 1921 the idea of the design competition had been abandoned and the concept of a provisional Parliament House conceived. The Commonwealth Chief Architect J S Murdoch was tasked with developing a scheme to build such a house to meet legislative requirements for an anticipated 50 years. There was debate as to where the structure should be sited, on the summit of Capital Hill or on Camp Hill as selected by Griffin. Murdoch suggested the site should be on "The Knoll" closer to the Molonglo River. This siting debate was to occur again in the 1960s and 1970s in regard to the permanent Parliament House. In July 1923 Parliament approved construction of the provisional Parliament House on "The Knoll" at an estimated cost of £225.000.00. The first sod on the site was turned in August 1923 by the Minister for Works and Railways, P G Stewart, using a steam shovel. The building was opened on 9 May 1927 having been completed by the Federal Capital Commission (formed in 1923) under the leadership of Sir John Butters. It was decommissioned after 61 years in 1988 on the opening of the permanent Parliament House on Capital Hill.

NPH

In 1978 the Fraser government decided to proceed with the replacement of the 1927 house with a new structure on Capital Hill. The government created the Parliament House Construction Authority (PHCA) and a two-stage competition was announced. The Authority consulted with the Royal Australian Institute of Architects and, together with the NCDC, issued a brief and competition documents. The design competition attracted 329 entries from 28 countries. The competition winner was the New York-based firm of Mitchell/Giurgola and Thorp with the Italian architect Romaldo Giurgola directing the on-site work.

The design involved burying most of the building in Capital Hill and capping the edifice with an enormous spire from which to fly the Australian flag. This flagpole reflected the shape of Griffin's capital. The facade included deliberate imitation of some of the patterns of Old Parliament House resulting in a slight resemblance despite the massive difference in scale.

Construction began in 1980 and the House was originally intended to be ready by Australia Day 26 January 1988, the 200th anniversary of European settlement in Australia. It was estimated to cost AU$220 million. Neither the deadline nor the budget were met. The building was opened by Queen Elizabeth II on 9 May 1988, the anniversary of the opening of both the first Federal Government in Melbourne on 9 May 1901 and the Provisional Parliament House in Canberra on 9 May 1927.

Heritage Listings

OPH

National Heritage List 20 June 2006

NPH

"Parliament House is not on any DSEWPaC heritage lists as this would require compliance with heritage requirements under the Environment Protection and Biodiversity Protection Act 1999 (EPBC Act) ... (which) would impinge on the authority of the Australian Parliament to administer its own affairs." (Parliament of Australia. Department of Parliamentary Services, *Parliament House Heritage Management Framework,* Commonwealth of Australia 2011.

2. ASSESSMENT OF SIGNIFICANCE

Historic Significance

OPH

The design and construction of the Provisional Parliament House leading to its opening in 1927 along with the provision of power, water and sewerage services, marked completion of that essential initial phase of the development of Canberra as the Federal Capital and enabled the transfer of the Federal Parliament and its support services from Melbourne to the ACT. Its continuing presence on the land axis of the Parliamentary Triangle is a reminder of the federation of the Australian colonies and the human activity that involved. It and the structure behind it that replaced it are indicative of the process of the development and growth of the nation.

NPH

By the 1970s the provisional Parliament House was grossly inadequate for its role which began about 50 years previously and the need for a permanent replacement was becoming more and more urgent. The decision of the Fraser government to proceed with the building of the new Parliament House marked the commencement of a new phase in history of the Capital's principal building. It is a symbol of the confidence and wealth of the nation, and has become the icon of the national capital.

Historic Individuals or Association

OPH

John Smith Murdock, Commonwealth Chief Architect, Director-General of Works, FCC Commissioner.
Walter Burley Griffin, Australian National Capital design winner.
Colonel Percy Owen, Director-General of Works, 1904 – 1924, then Chief Engineer, Federal Capital Commission (FCC).
Thomas Hill, Chief Engineer, Department of Home Affairs.
Ernest de Burgh, Chief Engineer for Water Supply and Sewerage, Department of Works, NSW.
James Brilliant, Clerk of Works.
Sir John Butters, first Commissioner of the FCC.
Prime Ministers from Bruce to Hawke including war time Prime Ministers Curtin and Chiffley, and Menzies who reinvigorated Canberra as the national capital, Whitlam's dismissal and speech from the front steps.

NPH

HRH Queen Elizabeth II, Queen of Australia.
Walter Burley Griffin, Australian National Capital designer winner.
Malcolm Fraser, Prime Minister of Australia, 1978.
R J Hawke, Prime Minister of Australia, 1988.

Parliament House Construction Authority, Chair - Sir Bernard Callinan, Member – Sir John Overall,
National Capital Development Commission.
Department of Housing and Construction.
Sir John Overall, Chairman of Panel of Assessors, former Commissioner of NCDC.
Mitchell/Giurgola and Thorp, Design Competition winner. (Richard Thorp, Designated Architect)
R P S Dalgleish, ASTC, MIE Aust., Project Manager.
Structural engineering consultants – Irwin Johnston and Partners
(A complete list of consultants appears on Page 221 of Reference D).

Creative or Technical Achievements

OPH

In accord with the concept of it being a provisional Parliament House, Murdock produced a design which was simple and functional. Needing to be constructible from available materials and within the capabilities of the local tradesmen, there was little leading edge technology or radical concepts incorporated in the structure. Whist it was conventional, the engineering services were advanced, diverse and highly refined. These included lighting and power, central heating, air conditioning of the chambers, lifts, fire protection, sychronised clocks and division bells, telephones, a vacuum document transfer system linking Hansard to the printing works, ducted vacuum cleaning and extensive kitchen facilities. Over time, sound reinforcement and radio broadcasting was added to the chambers.

NPH

The design brief for new Parliament House required the use of conventional tried technology and materials consistent with the capabilities of local industry. Reinforced concrete was selected as the main structural material. Nevertheless, there were major challenges to be faced in the construction process. These included the preparation of the site involving the temporary removal of the top of Capital Hill, the total and permanent removal of Camp Hill and Cork Hill and the extensive grading of the top end of the Parliamentary Triangle. The uniqueness and vastness of the design – at one stage there were nine overhead cranes on the site - required detailed examination of structural, building and economic characteristics in choosing methods of construction. Some of these were subsequently varied after feedback during the tendering process. With the design life of the building of 200 years, special attention was paid to structural elements including extensive use of stainless steel attachments and bolts. The flagmast structure required unique design and construction processes and led to the Construction Category Award at the 1989 BHP Steel Awards. The matter of roof cladding attracted extensive research and investigation and the involvement of groups such as the CSIRO and New Jersey based ARMM Consultants. For full details of these and other challenging engineering aspects of the structure, see Attachment E.

In addition to the engineering complexities of the House itself, significant challenges confronted those charged with the design and construction of the roads and bridges of the new edifice. As described in Attachment F, the task involved extensive study of options for the roads required to effectively service the House and the construction of roads, bridges and a tunnel needed to implement the chosen solution.

Together with the implementation of the tasks before them, engineers were driven by the need to ensure works carried out were to the highest standards to ensure they would last 200 years and that they were visually appropriate for the nation's premier building.

Research Potential

OPH

There is little potential for archaeological research of the site but limitless potential for documentary research particularly in regard to political activities of the nation spanning the 61 years of its use as the Federal Parliament House. Many of the fittings and fixtures are original and provide excellent publically available examples of the design of services from the 1920s through to the 1980s.

NPH

Now 25 years old and 1/8th of its way through its design lifespan, there also seems little potential for research – most aspects of its conception, construction and subsequent use have been and are being well documented. It is likely it will be regarded as a benchmark for buildings of its type and be referred to when similar problems such as in-ground roof sealing challenges are encountered.

Social

OPH

It can be argued that three major events united the British colonies in Australia into one nation with a strong sense of nationhood:

- the act of federation in 1901;
- the First World War and particularly the Gallipoli landing in 1915; and
- the opening of the Parliament House in Canberra in 1927.

The completion of the provisional Parliament House enabled the transfer of the federal parliament and its services to Canberra thereby giving the fledgling nation of 6 million citizens a national capital with a dedicated Parliament House.

NPH

Who of us can stand on the lookout on Mount Ainslie or on the steps of the Australian War Memorial and not have a feeling of awe and national pride at the vista before us? The scene down Anzac Parade across the lake to Old Parliament House in the middle distance topped with Parliament House with its magnificent flagmast at the top of the Parliamentary Triangle, must stir all but the most cynical

Australian hearts. New Parliament House has done much to make the national capital the object of an at-least-once-in-a-lifetime pilgrimage of all Australians. The genius of the Giurgola design has resulted in the Parliament House becoming the symbol of the national capital and the object of intense national pride.

The new House contains many aspects of social significance including the textile hangings created by women around Australia. It has seen the passing parade of prime ministers and governments from Hawke to Gillard, Australia's first female prime minister.

Rarity

Both houses are unique.

Representativeness

OPH

Represents the Simplified or Stripped Classic architecture style selected by J S Murdoch for a provisional Parliament House as the pinnacle of the style he developed now known as the Federal Capital Style. The engineering services are diverse and appropriate to the needs and circumstances and are highly representative of the leading technologies of the times,

NPH

Giurgola produced a brilliant design for the new Parliament House; the engineering skills applied to its construction were equal to the complex task and represent the highest qualities of the profession at the time.

Integrity/Intactness

OPH

Given its 61 years of service as the federal Parliament House and the necessary changes made to it during that period, the building has integrity and is intact.

NPH

The building is in near-original condition and intact.

References

Referred to documents are listed below.

Statements of Significance

OPH

For 61 years this was the premier building in Australia's national capital. Its construction along with the provision of water, power and sewerage services, marked the completion of the initial core phase of the creation of a national capital and enabled the transfer of the Federal Parliament from Melbourne. It is symbol of the federation of the colonies/states and as such is a most significant national building. It is associated with all major events, both political and social, in the nation for over 60 years. It has a special place in the hearts of Australians – particularly Canberrans – and continues to serve as ***"The Museum of Australian Democracy in Old Parliament House"***.

NPH

The brilliance of the Giurgola design for the new Parliament House required the application of works of engineering excellence in its construction. This process took ten years, 10,000 workers and over AU$I billion to complete. It soon became a symbol of national pride, confidence, prosperity, aspirations and maturity and is the icon of the national capital.

Assessed Significance

Given the national significance of both Parliament Houses and their part, past, present and future, in the events of Australia, it is considered they both, individually and collectively, warrant recognition under the Engineering Heritage Recognition Program as **Engineering Heritage National Landmarks.**

Images with captions

See Attachment G.

Interpretation Panel

The interpretation panel is expected to be installed in Federation Mall approximately half way between the old and new Parliament Houses. Plans are for the panel to be composed of two parts each occupying half the area, The left half will contain images and text relating to Old Parliament House, and the right side containing that of new Parliament House. The panel could contain a statement that the awards were made and unveiled during the 17th National Engineering Heritage Conference held in Canberra as part of the city's 100 year anniversary celebrations. Negotiations will need to be held with the National Capital Authority to ensure the form and content of the panel are acceptable.

Attachments:

A. Copies of Owners' Letters of Agreement.

B. Map 51 of Gregory's *Canberra & Queanbeyan Street* Directory, 26th Edition.

C. Wikipedia document "Old Parliament House, Canberra" dated 31 May 2013.

D. Wikipedia document "Parliament House, Canberra" dated 31 May 2013.

E. *Canberra's Engineering Heritage, Second Edition, 1990,* Chapter Thirteen "The New Parliament House", R P S Dalgleish, A E Taylder.

F. *Canberra's Engineering Heritage, Second Edition, 1990,* Chapter Fourteen "The Roads and Bridges leading to the New Parliament House", K E Downey, J K Connel.

G. Images with Captions.

H. Sample Text for an Interpretation Panel.

References:

1. Baker. Keith "*Old Parliament House – Engineering Heritage Study*", January 2003.

2. Baker. Keith "A Century of Canberra Engineering", May 2013

3. Headon. David "*The Symbolic Role of the National Capital*", National Capital Authority, *2013*

4. Daley. Charles "*As I Recall – Reminiscences of Early Canberra*" 1994

5. Pegrum. Roger "*The Bush Capital – How Australia Chose Canberra as its Federal Capital*" 2008

6. Andrews. W C Shelllshear. W Cooper. I Pascoe. L Morison. I Price. C J Dalgarno. K J Minty. A E Jones. H A Clark. P Yonge. P Corbett. A H Cooke. TH Leslie. R Dalgleish. R P S Taylder. A E Downey. K E Connal. J K *Canberra's Engineering Heritage* 1990.

7. Quarterly Bulletin of the Institution of Engineers Australia, Vol V, No 8, 30 April 1928

8. Chandler. David "Construction of Australia's New Parliament House 25 years on – May 2013. http://constructionedge.com.au/wp-content/uploads/2013/03/Article-R-1-NPH-the-challenge.pdf

Acknowledgments:

The author of this document acknowledges the contributions of these engineers without whose documents the drafting of this submission would have been far more difficult than it was.

ATTACHMENT A

ATTACHMENT A1

Letter of Agreement from Museum of Australian Democracy, Old Parliament House.

From: Jans, Edwina [mailto:Edwina.Jans@moadoph.gov.au]
Sent: Friday, 14 June, 2013 6:14 PM
To: Lyndon Tilbrook
Subject: RE: Engineering Nomination Letter [SEC=UNCLASSIFIED]

Hi Lyndon

Just confirming that Old Parliament House is happy to support EHC's proposal to nominate Old Parliament House for recognition of its engineering significance.

By the way, I found this re the cooling & heating. It appears that Keith Baker found the answer…

http://moadoph.gov.au/blog/not-just-hot-air-in-the-chambers/

best wishes

Edwina

Edwina Jans
Manager, Heritage and Interpretation
18 King George Terrace Parkes ACT 2600
Australia
PO Box 7088, Canberra BC ACT 2610
p 02 6270 8234 f 02 6270 8188 m 0425 253 571
edwina.jans@moadoph.gov.au moadoph.gov.au

ATTACHMENT A2

Letter of Agreement from Parliamentary Services, Parliament House.

From: Wurst, Ilse (DPS) [mailto:Ilse.Wurst@aph.gov.au]
Sent: Monday, 13 May, 2013 5:52 PM
To: Lyndon Tilbrook
Subject: RE: Briefing for APH Heritage Advisory Board - Tilbrook, Engineers Australia

Dear Lyndon

Apologies for the short response last week on the telephone.

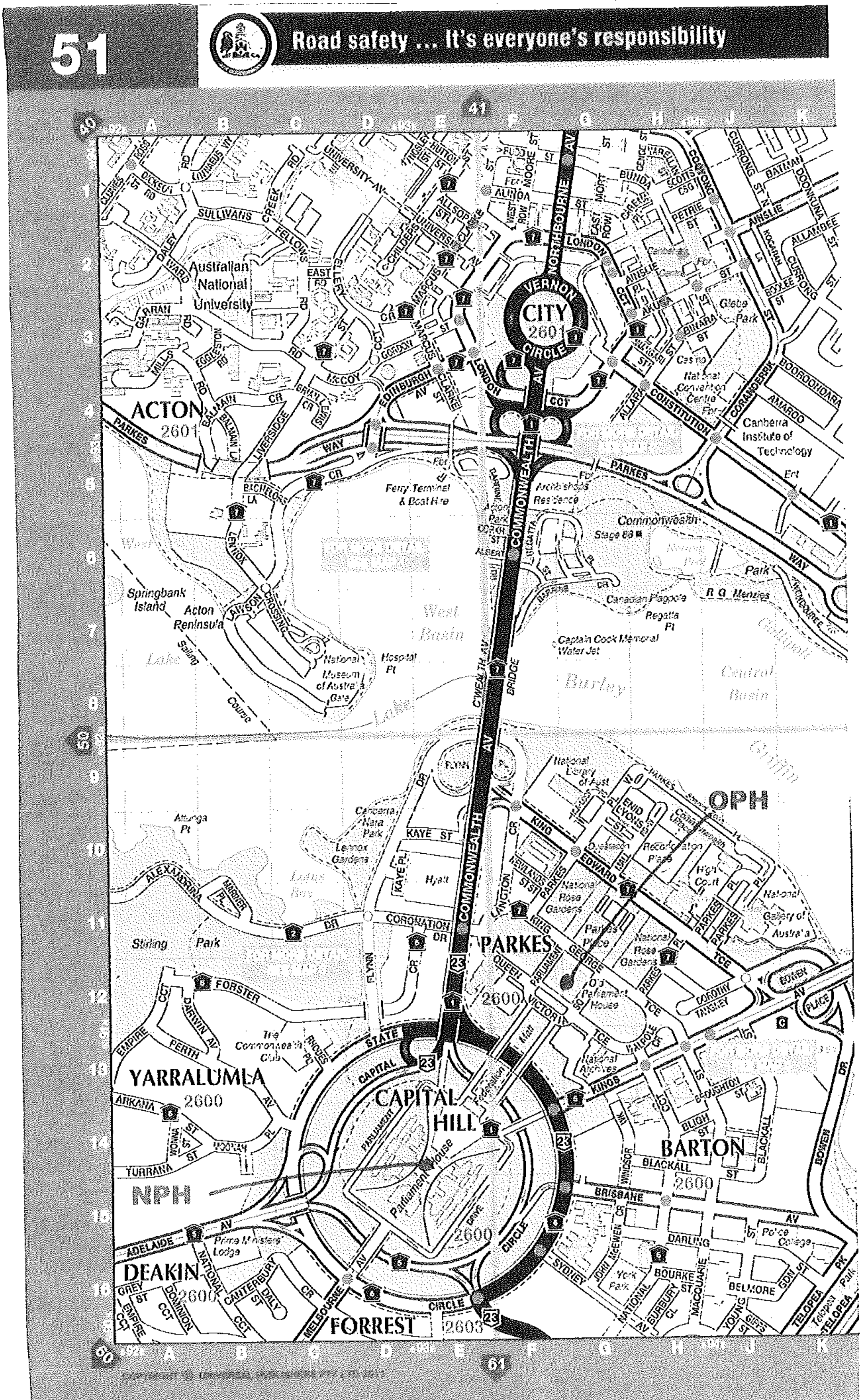
The Heritage Advisory Board met last week on 8 May and considered the request from Engineers Australia about the nominating Parliament House for engineering heritage recognition. In short, given that the proposal for a small plaque or interpretive panel is to be located in Federation Mall, not on the Parliament building itself, the Board was supportive in-principle of the proposal.

A formal response to your letter will be provided shortly.

Kind regards, Ilse

Ilse Wurst
Director Heritage
Strategy and Performance Branch
Department of Parliamentary Services
T: 02 6277 5095
M: 0428 808 552
E: ilse.wurst@aph.gov.au

ATTACHMENT B

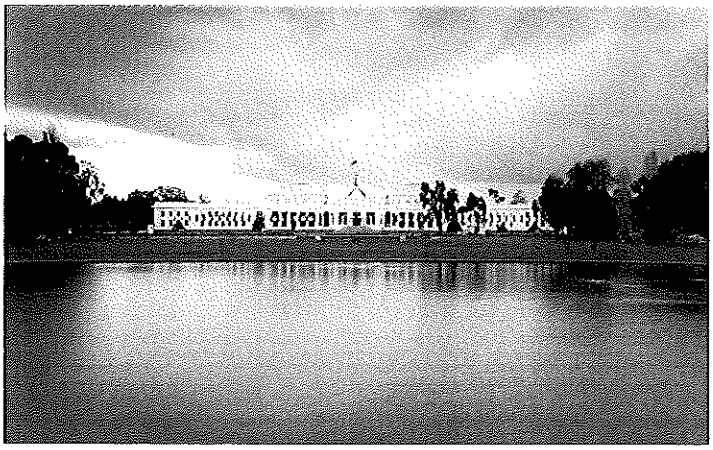


51
Road safety ... It's everyone's responsibility
Australian National University
ACTON
2601
CITY
2601
VERNON
CIRCLE
NORTHBOURNE AV
COMMONWEALTH AV
PARKES WAY
CONSTITUTION AV
EDINBURGH AV
LONDON CCT
Canberra Institute of Technology
National Convention Centre
Casino
Glebe Park
Ferry Terminal & Boat Hire
Commonwealth Park
Archbishop's Residence
Commonwealth Stage 88
Springbank Island
Acton Peninsula
National Museum of Australia
West Basin
Canadian Flagpole
Regatta Pt
Captain Cook Memorial Water Jet
Burley
Central Basin
Lake
Griffin
National Library of Aust
OPH
KING EDWARD TCE
National Rose Gardens
High Court
National Gallery of Australia
Old Parliament House
PARKES
2600
Canberra Nara Park
Lennox Gardens
Hyatt
Attunga Pt
Lotus Bay
Stirling Park
CORONATION DR
ALEXANDRINA DR
FORSTER CCT
The Commonwealth Club
STATE CIRCLE
CAPITAL CIRCLE
CAPITAL HILL
Parliament House
2600
YARRALUMLA
2600
NPH
ADELAIDE AV
Prime Ministers' Lodge
DEAKIN
2600
FORREST
2603
BARTON
2600
National Archives
KINGS AV
BRISBANE AV
BLACKALL ST
DARLING
York Park
Police College
SYDNEY AV
MELBOURNE AV
CANBERRA AV

ATTACHMENT C

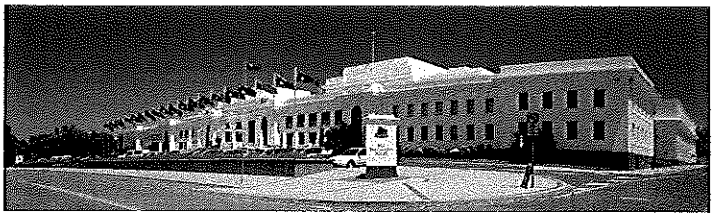
Old Parliament House, Canberra

Parliament House, known formerly as the **Provisional Parliament House**, was the house of the Parliament of Australia from 1927 to 1988. The building began operation on 9 May 1927 as a temporary base for the Commonwealth Parliament after its relocation from Melbourne to the new capital, Canberra, until a more permanent building could be constructed. In 1988, the Commonwealth Parliament transferred to the new Parliament House on Capital Hill. It also serves as a venue for temporary exhibitions, lectures and concerts.



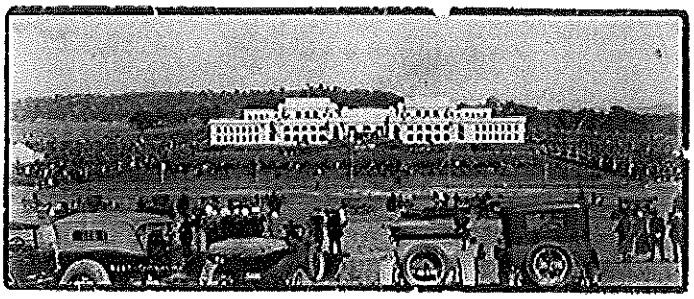
Old Parliament House as viewed from the front

On 1 May 2008 it was made an Executive Agency of the Department of the Prime Minister and Cabinet.[] On 9 May 2009, the Executive Agency was renamed the **Museum of Australian Democracy at Old Parliament House**, reporting to the Special Minister of State.



Old Parliament House viewed from Queen Victoria Terrace

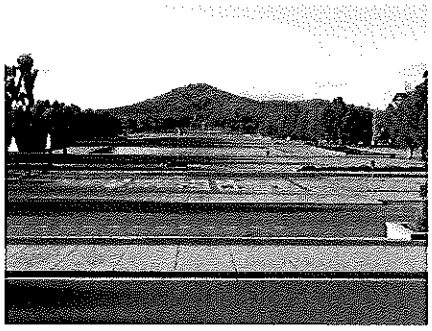
Designed by John Smith Murdoch and a team of assistants, the building was intended to be neither temporary nor permanent—only to be a 'provisional' building that would serve as a parliament for fifty years. The design extended from the building to include its gardens, décor and furnishings. The building is in the Simplified or "Stripped" Classical Style, commonly used for Australian government buildings constructed in Canberra during the 1920s and 1930s. It does not include such classical architectural elements as columns, entablatures or pediments, but does have the orderliness and symmetry associated with neoclassical architecture.[1]



Opening of Parliament House in May 1927

Location

Old Parliament House is at the base of Capital Hill at the centre of the Parliamentary Triangle, which itself forms of the heart of Walter Burley Griffin's design for Canberra - an open vista of Lake Burley Griffin, Anzac Parade, the Australian War Memorial and Mount Ainslie beyond.



View to Mount Ainslie from the front steps. The Australian War Memorial is at the base of the mountain, at centre of picture

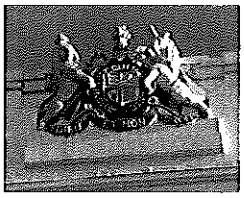
On either side of the building are situated the Parliamentary Gardens—one each for the House of Representatives (eastern side) and the Senate (western side)—which Murdoch intended as integral elements of the building, to provide both diversion and contemplative space for members and senators. The gardens were neglected for a period after the building was vacated by the parliament in 1988. After restoration, they were officially reopened to the public in 2004, now known as the National Rose Garden. (More detail is provided in the *Gardens* section below.)

Façade and design elements

Old Parliament House is a three storey brick building with the principal floor on the middle level. Murdoch designed it to be simple and functional, and this is reflected throughout the design, extending to the interior fittings and furnishings.

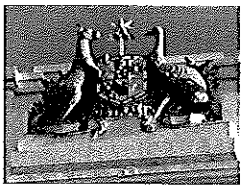
Central façade and steps to front entrance

The façade originally incorporated a grid of recessed openings and balconies, with four bays having arched bronze windows and stepped parapets. The building's front façade has strong horizontal lines, displaying only two storeys, with higher massed elements behind the façade on either side of the centre, indicating the location of the two debating chambers, with a lower mass in the centre where King's Hall is located. Murdoch's simplified classical design is based on a basic square, which provides the building with a regular proportion in terms of fenestration and other elements, including the (now enclosed) verandas and colonnades.



Royal arms

The building was constructed from Canberra clay brick, with timber and lightweight concrete floors. It was rendered originally in white concrete, since painted, except for a pedestal of bricks left with their natural colour. The original roofs were constructed of flat concrete slabs with a membrane waterproofing and finished with a bituminous coating which was designed to be walked on. At the roofline, on either side of the main entrance, are large painted reliefs of the Royal and Commonwealth coats of arms.



Australian arms.

The interior continues the stripped-classicism of the exterior, with the use of common motifs and simple lines, in both the decor and furnishings. To represent the federal nature of the Commonwealth of Australia, the building also makes extensive use of timbers from various parts of Australia, with a timber native to each state being used for different purposes. The building is also designed to make good use of natural light from windows, skylights and light-wells.

It can be seen from the illustrations that considerable restoration and maintenance effort is being lavished on this building. To this end, activities are performed as detailed in a Heritage Management Plan.[2]

Plan

In keeping with its classicised forms, the building has strong symmetrical planning based on a number of major spaces. The major axis through the building, which is part of the land axis of Walter Burley Griffin's design, is through King's Hall, the Parliamentary Library and the dining rooms at the back. The cross-axis features the House of Representatives and Senate chambers on either side of King's Hall.

The door at right is an entrance to the Senate chamber from this corridor on the north-western side of King's Hall. The location of the House of Representatives chamber is like a mirror image on the opposite (south-eastern) side.

Originally having an H-shape, the building now forms a large rectangle as a consequence of various extensions, with a small rear projection. The building now contains four courtyards and some light-wells. The courtyards are surrounded by colonnades at ground level and (now enclosed) verandas on the main floor.

At the centre is King's Hall. It is named for King George V, whose statue is in the room. Directly adjacent to King's Hall are the chambers of the House of Representatives (to the south-east) and the Senate (to the north-west). To the rear is the Parliamentary Library (occupied from 1998 to 2008 by the National Portrait Gallery) and behind it the dining rooms.

The rest of the main floor of the building was given to offices and meeting rooms. On either side of each of the parliamentary chambers are meeting rooms for the government and opposition parties and—at the end of each block—what were intended originally to be suites for the Speaker of the House of Representatives and the President of the Senate. At the rear of the building were dining rooms for members and senators and for 'strangers'. On the basement level were service areas and some offices; on the top floor were more offices and the facilities of the parliamentary press gallery.

King's Hall

The central King's Hall, which is between the chamber of the House of Representatives at left and the Senate at right

From the entrance, a flight of stairs leads up to King's Hall. King's Hall is a large square room, with an ambulatory around the outer edges. It is entered from the main central entrance and up a flight of stairs. The central space has a coffered ceiling and is lit from above by clerestory windows on all four sides. The floor is parquetry, made of jarrah and silver ash woods. Dominating the room is a larger than life bronze statue of King George V, monarch at the time the building was completed, but who, as Duke of York, also represented his father King Edward VII at the opening of the first Commonwealth Parliament on 9 May 1901 in Melbourne.

On eight of the columns surrounding the room are bronze reliefs of persons prominent in the formation of the Commonwealth. In the ambulatory are portraits of Australian Governors-General, Prime Ministers, Speakers of the House of Representatives and Presidents of the Senate, and pictures of events associated with the building, such as the opening ceremony of 1927.

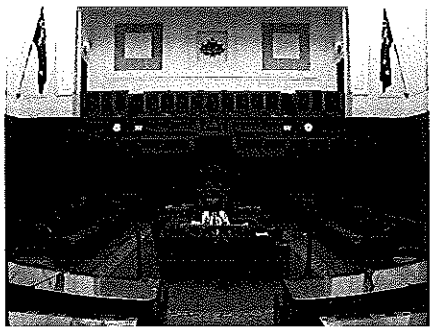
The chambers

The chambers of the Senate and House of Representatives are large internal spaces, with ceilings considerably higher than that of King's Hall. Both chambers are the same size, despite the requirement of section 24 of the Australian Constitution that the House of Representatives should have, as nearly as practicable, twice the number of members as the Senate. Both are lined with timber panelling, again representative of Murdoch's simplified classical style, with furnishings in a similar style. The timber used in the wall panelling, the desks, seats and tables is all Australian black bean wood and Tasmanian blackwood. The hand-woven carpets in each chamber have a pattern of eucalyptus leaves and wattle blossom.

The Senate chamber

The Senate is characterised by the predominance of the colour red, in both the carpet and the red leather of the seating and desks. This reflects its role as the upper house and as a deliberative house like the House of Lords at Westminster. The seating is in a horse-shoe pattern, around a central table. Each senator had a seat and a desk, including those sitting on the front benches (i.e., ministers). At the end of the table is a desk for the clerks and behind them a large chair for the president. Behind it are two thrones, to be used by the monarch and consort or, in their stead, the Governor-General and spouse, at official occasions such as the State Opening of Parliament. The furnishings conform to Murdoch's simplified classical style.

The walls of the Senate chamber are lined with blackbean timber (which is also used for the furnishings) and above this are located galleries on each side. The gallery above the throne was reserved for the press, with others used by the guests of senators, members of the House of Representatives and the general public.



The House of Representatives chamber

The House of Representatives largely corresponds, in terms of design elements, to the Senate. However, the chamber is characterised by the colour green, representing the historic inheritance of the Representatives, as the lower house and the house in which governments are formed, from the House of Commons in the Palace of Westminster.

There are three basic differences between the House of Representatives chamber and that of the Senate. Firstly, the House is more crowded with seating than the Senate, reflecting the requirement for double the number of members. Secondly, the front benches are long, continuous benches with no desks, similar to the front benches of the House of Commons. Thirdly, the Speaker's Chair presents a significant stylistic contrast, as it is a copy of A.W.N. Pugin's Speaker's Chair in the British House of Commons, presented to the Australian Parliament by the British branch of the Empire Parliamentary Association in 1926. This chair was then copied for the replacement of the original Speaker's Chair in the House of Commons, destroyed in an air raid during the Second World War, which was a gift of the Australian Parliament to the House of Commons. The Royal coat of arms over the chair is carved in oak from timber originally built into Westminster Hall in 1399. The hinged flaps of the armrests are of oak from Nelson's flagship *HMS Victory*, in the Battle of Trafalgar (1805). The chair symbolises the Australian Parliament's associations with British history and the Parliament at Westminster.

Interiors

The Murdoch-designed interiors remain in substantial areas of the building, sometimes with their original furnishings. The three best-preserved interiors, other than King's Hall and the Chambers, are the Government party room (on the House of Representatives side), the Senate club room (also called the Senate Opposition party room) and the Clerk of the Senate's office (which was originally the President of the Senate's office). All retain their original fittings and furnishings, designed by Murdoch and his team in accordance with the simplified classical design scheme. These are characterised by simple forms, based on Murdoch's square motif.

Former party room of the National Party, originally named the Country Party. As in the new Parliament House, a red and/or green light flashed below the clock to signal the occurrence of a division (voting) of the Senate or House respectively.

The original building was small and did not provide individual offices for all members. To an extent, this was to be mitigated by ministers having offices in their own departments, originally in the east and west blocks (also designed by Murdoch). For this reason, the party rooms are not just meeting rooms but contain private phone booths, washbasins, desks and small areas for more intimate discussions.

Gardens

The Parliamentary Gardens were designed as an extension of the building, retaining a formality in keeping with it. Originally, the rear courtyards of the building were open to the gardens through a colonnade, Murdoch's intention being that members and Senators should be able to use the gardens as an integral part of the building. Later this intention was lost, as extensions were added to the back part of the building to provide more offices.

They are enclosed by hedges and were planted with trees. In both cases they were divided into four quadrants, with two being occupied by rose gardens and the remaining two by recreational facilities. On the Senate side these are tennis courts and a cricket pitch and on the Representatives' side, they are tennis courts and a bowling/croquet green. In the 1970s much of the Representatives' gardens were covered by an extension to the building, but this has now been removed and the gardens restored.

The rose gardens contain a wide variety of specimens, including many old roses and roses donated by prominent Australians and overseas bodies and individuals. Much of the inspiration (and organisation) for this came from the Usher of the Black Rod and later Clerk of the Senate, Robert Broinowski, and the gardens were designed by Rex Hazlewood. They also played major roles in the development of the National Rose Gardens on the other side of King George Terrace.

Extensions

Old Parliament House was only intended to be 'provisional' and so office space was not provided for all members. This shortage of space was compounded by the decision of Prime Minister James Scullin to relocate his principal office from West Block to the building in 1930. This eventually resulted in all ministers, with their departmental staff, being accommodated in the building over time, compounding the office space problem.

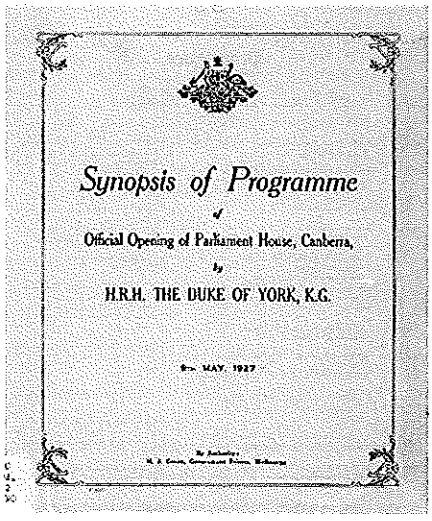
The Prime Minister's office

The first extensions were made to the rear of the building in 1947 to provide more office space for members. Some further extensions were constructed in 1964. In the 1970s large extensions were added to both sides of the building and the south-west corner. The front façade was extended in a sympathetic fashion to conform with Murdoch's design. On the Representatives side, larger extensions were required, and a substantial part of the gardens were built over and linked to the main building by a bridge.

The interiors of the 1972-73 extensions reflect fashions of the time, although wooden panelling was used for the walls, in keeping with the older parts of the building, but with an unequivocally 1970s style. On the Representatives side, the extensions necessitated the demolition of the Prime Minister's suite of offices (originally intended for the Speaker) and the original Cabinet Room. The rooms are now left in the condition they were in at the time they were occupied by Bob Hawke, immediately prior to the move to New Parliament House in May 1988. Similar extensions were made on the Senate side, with a new suite of rooms being constructed for the President of the Senate in a similar style.

History

A competition was announced on 30 June 1914 to design Parliament House, with prize money of £7,000. However, due to the start of World War I the next month, the competition was cancelled. It was re-announced in August 1916, but again postponed indefinitely on 24 November 1916. In the meantime, John Smith Murdoch, the Commonwealth's Chief Architect, worked on the design as part of his official duties. He had little personal enthusiasm for the project, as he felt it was a waste of money and expenditure on it could not be justified at the time. Nevertheless, he designed the building by default.[3] The construction of Old Parliament House was commenced in August 1923 and completed in early 1927. It was built by the Commonwealth Department of Works, using tradesmen and materials from all over Australia. The final cost was about £600,000, which was more than three times the original estimate.



Synopsis of Programme

Official Opening of Parliament House, Canberra,

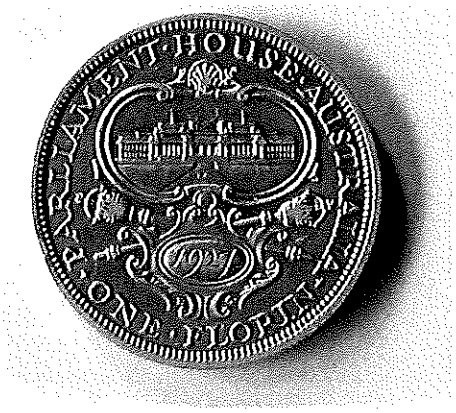
by

H.R.H. THE DUKE OF YORK, K.G.

9th MAY, 1927

The programme for the opening of Parliament House on 9 May 1927

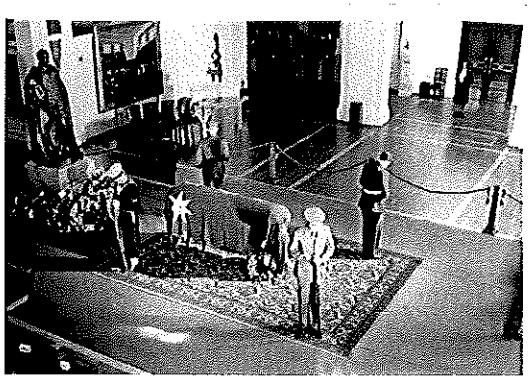
In 1923, Canberra was a small, dispersed town with few facilities and no administrative or parliamentary functions. The building of Old Parliament House effectively doubled the town's (very small) population. The workers required for the project and their families were housed in camps and settlements and endured Canberra's harsh weather conditions. Once Parliament commenced sitting in Canberra the transfer of Commonwealth public servants from Melbourne required the construction of suitable housing in the areas of Ainslie, Civic, Forrest (formerly called Blandfordia), Griffith and Kingston.



Reverse of the 1927 commemorative florin depicting Old Parliament House

The building was opened on 9 May 1927 by the Duke and Duchess of York (later King George VI and Queen Elizabeth The Queen Mother). The opening ceremonies were both splendid and incongruous, given the sparsely built nature of Canberra of the time and its small population. The building was extensively decorated with British Empire and Australian flags and bunting (similar schemes were used at later events, most notably in 1954 when Queen Elizabeth II visited Canberra for the first time and opened Parliament). Temporary stands were erected bordering the lawns in front of the Parliament and these were filled with crowds. A Wiradjuri elder, Jimmy Clements, was one of only two aboriginal Australians present, having walked for about a week from Brungle Station (near Tumut) to be at the event. Dame Nellie Melba sang the National Anthem (at that time *God Save the King*). The Duke of York unlocked the front doors with a golden key, and led the official party into King's Hall where he unveiled the statue of his father, King George V. The Duke then opened the first parliamentary session in the new Senate Chamber.

Prime Minister John Curtin, who died in office, and Ben Chifley, a former Prime Minister, both lay in state in King's Hall after their deaths in 1945 and 1951 respectively. On 26 January 1972 a number of Aboriginals set up tents and signs in protest about Aboriginal rights and called the assemblage the Aboriginal Tent Embassy. On 11 November 1975, David Smith, Official Secretary to the Governor-General, read a proclamation from the front steps announcing the dissolution of Parliament that followed the dismissal of the Whitlam government by Sir John Kerr; afterwards, Gough Whitlam addressed the crowd and his remarks have become a famous part of Australia's political history.



John Curtin's casket lay in State in King's Hall, Old Parliament House, July 1945.

By the 1980s Old Parliament House had exceeded its capacity and was in need of considerable repair and renovation. For this reason, in the late 1970s Malcolm Fraser's government committed to the building of a new Parliament House. After the opening of new Parliament House by Queen Elizabeth II on 9 May 1988, old Parliament House continued to be used for a few weeks. The final session ended when the Senate was adjourned at 12:26 am on Friday 3 June, by the President, Senator Kerry Sibraa.[4] After this, the Old Parliament House was left vacant for several years.

After Parliament relocated to the new building, there was a debate on whether to demolish Old Parliament House. During the 1920s it had been argued by some, including Walter Burley Griffin, that the building's position would interfere with the vista of a permanent Parliament House. Burley Griffin had likened the placement of the Old Parliament House to 'filling the front yard with outhouses' as the building would interfere with the land axis from Mount Ainslie to Capital Hill.

After considering the building's historic significance in the history of twentieth century Australia, the government decided that it should remain. However, it remained unclear what its future purpose would be. In the end it was decided that its most suitable use would be a 'living museum of political history.'[5]

The building was re-opened in December 1992.[] It is now an Executive Agency of the Department of the Prime Minister and Cabinet, run as a museum.

National Portrait Gallery

The Library of the Parliament House was opened as the interim National Portrait Gallery, before that moved to a new building in early 2009.

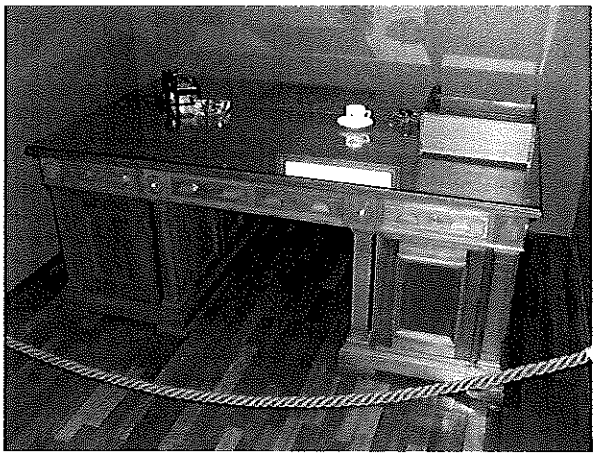
Museum of Australian Democracy

The building re-opened in May 2009 as the **Museum of Australian Democracy at Old Parliament House** to celebrate democracy and Australia's political history.[6]

Australian Prime Ministers Centre

The Australian Prime Ministers Centre is the first stage of the Museum of Australian Democracy. It "supports research into the history, origins and traditions of Australian democracy, with a particular focus on Australian prime ministers."[7]

The Centre offers fellowships to "established researchers and artists interested in the history, origins, traditions and contemporary practice of Australian democracy, with special reference to Australian prime ministers."[8]



Desk of former Prime Ministers of Australia, on show in the Museum of Australian Democracy, Old Parliament House, Canberra, Australian Capital Territory. Used by Prime Ministers from Stanley Bruce (from 1927) to Bob Hawke (1988), then in the new Parliament House by John Howard (1996-2007).

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[1] http://en.wikipedia.org/wiki/Old_Parliament_House,_Canberra#endnote_PGIAA

[2] Heritage management plan (http://www.oph.gov.au/files/oph-hmp-master.pdf) (Warning—this is a PDF file of 11 mB)

[3] Robert Messenger, *"Mythical thing" to an iced reality*, in "Old Parliament House: 75 Years of History", supplement to the Canberra Times, 4 May 2002.

[4] President's valedictory (http://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;adv=yes;db=CHAMBER;group=;holdingType=;id=chamber/hansards/1988-06-02/0233;orderBy=customrank;page=0;query=Date:02/06/1988 >> 03/06/1988 Dataset:hansards;querytype=;rec=0;resCount=Default), Adjournment of the Senate (http://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;adv=yes;db=CHAMBER;group=;holdingType=;id=chamber/hansards/1988-06-02/0245;orderBy=customrank;page=0;query=Date:02/06/1988 >> 03/06/1988 Dataset:hansards;querytype=;rec=0;resCount=Default)

[5] To Demolish or Not to Demolish (http://moadoph.gov.au/the-house/the-history-of-the-house/to-demolish-or-not-to-demolish/) at Museum of Australian Democracy, Old Parliament House

[7] Prime Ministers (http://moadoph.gov.au/prime-ministers/), Museum of Australian Democracy accessed 19 August 2011.

[8] Fellowships (http://moadoph.gov.au/prime-ministers/research-program/fellowships/), Museum of Australian Democracy accessed 19 August 2011.

Notes

1. ^ Apperly, Richard; Robert Irving, Peter Reynolds (1989). *A pictorial guide to identifying Australian architecture* (Paperback, 1994 ed.). Sydney, Australia: HarperCollins. ISBN 0-207-18562-X.
2. ^ Charlton, Ken; Rodney Garnett, Shibu Dutta (2001). *Federal Capital Architecture Canberra 1911-1939* (2nd Edition, Paperback, 2001 ed.). Canberra, Australia: National Trust Of Australia (ACT). ISBN 0-9578541-0-2.
3. ^ Metcalf, Andrew (2003). *Canberra Architecture* (1st Edition, Paperback, 2003 ed.). Sydney, Australia: The Watermark Press. ISBN 0-949284-63-7.

External links

- Museum of Australian Democracy at Old Parliament House (http://moadoph.gov.au/)
- The Parliament of Australia (http://www.aph.gov.au/)
- National Trust of Australia (ACT) (http://www.act.nationaltrust.org.au/places/old_parl_house.html)

Coordinates: 35.302097°S 149.12992°E (http:/ / tools. wmflabs. org/ geohack/ geohack. php?pagename=Old_Parliament_House,_Canberra& params=-35. 302097_N_149. 12992_E_type:landmark_region:AU)

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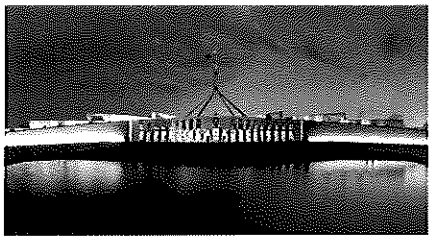
ATTACHMENT D

Parliament House, Canberra

Parliament House	
	
The main entrance and the flag mast	
General information	
Location	Canberra, Australian Capital Territory
Country	Australia
Construction started	1981
Completed	1988
Inaugurated	9 May 1988
Cost	A$1.1 billion
Height	107 metres
Technical details	
Floor area	250,000 m²
Design and construction	
Architect	Romaldo Giurgola
Architecture firm	Mitchell/Giurgola Architects

Parliament House is the meeting facility of the Parliament of Australia located in Canberra, the capital of Australia. The building was designed by Mitchell/Giurgola Architects and opened on 9 May 1988 by Elizabeth II, Queen of Australia.[1] Costing more than A$1.1 billion, it was the most expensive building in the world at the time of its construction.[*citation needed*]

Federal Parliament meetings were first held in Melbourne until 1927. Prior to 1988, the Parliament of Australia met in the Provisional Parliament House, which is now known as "Old Parliament House". Construction of Australia's permanent Parliament House was delayed while its location was debated. Construction of the new building began in 1981. The principal design of the structure is based on the shape of two boomerangs and is topped by an 81-metre flagpole.

It contains 4,700 rooms and many areas are open to the public. The main foyer contains a marble staircase and leads to the Great Hall which has a large tapestry on display. The House of Representatives chamber is decorated green while the Senate chamber has a red colour scheme. Between the two chambers is the Members' Hall which has a water feature and is not open to the public. The Ministerial Wing houses the office of the Prime Minister and other Ministers.

Before the establishment of Canberra

In 1901, when the six British colonies in Australia federated to form the Commonwealth of Australia, Melbourne and Sydney were the two largest cities in the country, but the long history of rivalry between them meant that neither could become the national capital. Section 125 of the Constitution of Australia therefore provided that:

Parliament House, Melbourne, was home to Federal Parliament for 26 years.

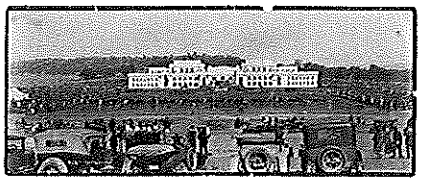
> *The seat of Government of the Commonwealth shall be determined by the Parliament, and shall be within territory which shall have been granted to or acquired by the Commonwealth, and shall be vested in and belong to the Commonwealth, and shall be in the State of New South Wales, and be distant not less than one hundred miles from Sydney.*
>
> *Such territory shall contain an area of not less than one hundred square miles, and such portion thereof as shall consist of Crown lands shall be granted to the Commonwealth without any payment therefor. The Parliament shall sit at Melbourne until it meet at the seat of Government.*

In 1909, after much argument, the Parliament decided that the new capital would be in the southern part of New South Wales, on the site which is now Canberra. The Commonwealth acquired control over the land in 1911, but World War I intervened, and nothing was done for some years to build the city. Federal Parliament did not leave Melbourne until 1927.

In the meantime the Australian Parliament met in the 19th century edifice of Parliament House, Melbourne,[2] while the Victorian State Parliament met in the nearby Royal Exhibition Building for 26 years.

Old Parliament House

After World War I the Federal Capital Advisory Committee was established to prepare Canberra to be the seat of government, including the construction of a Parliament House. The committee decided that it would be best to erect a "provisional" building, to serve for a predicted 50 years until a new, "permanent" House could be built. In the event, Old Parliament House was Parliament's home for 61 years. In the last decade of its use as a parliament the building had a chronic shortage of available space.[]



Old Parliament House opening, 1927

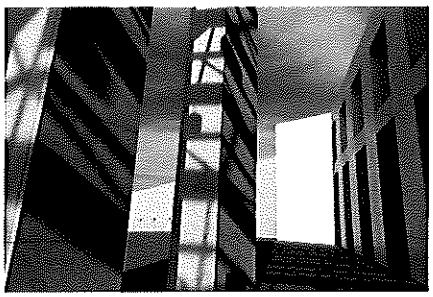
New Parliament House

In 1978 the Fraser government decided to proceed with a new building on Capital Hill, and the Parliament House Construction Authority was created.[] A two-stage competition was announced, for which the Authority consulted the Royal Australian Institute of Architects and, together with the National Capital Development Commission, made available to competitors a brief and competition documents. The design competition drew 329 entries from 28 countries.[]

The competition winner was the New York-based architectural firm of Mitchell/Giurgola, with the on-site work directed by Italian architect Romaldo Giurgola,[3][4] with a design which involved burying most of the building under Capital Hill, and capping the edifice with an enormous spire topped by a large Australian flag. The facades, however, included deliberate imitation of some of the patterns of the Old Parliament House, so that there is a slight resemblance despite the massive difference of scale.

The front architecture built into Capital Hill, including the forecourt and main entrance, and illustrating a ground level view of the boomerang-shaped design

Construction began in 1981, and the House was intended to be ready by Australia Day, 26 January 1988, the 200th anniversary of European settlement in Australia. It was expected to cost A$220 million. Neither the deadline nor the budget was met.[] The building was finally opened by Queen Elizabeth II on 9 May 1988, the anniversary of the opening of both the first Federal Parliament in Melbourne on 9 May 1901 by the Duke of Cornwall and York (later King George V),[5] and of the Provisional Parliament House in Canberra on 9 May 1927 by the Duke of York (later King George VI).[6]



View from the entrance to Parliament House, Canberra

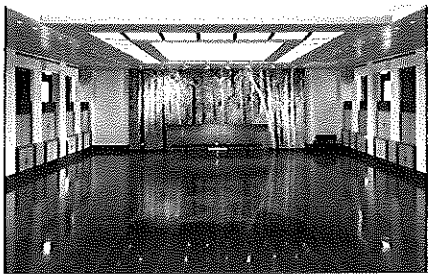
The flag flown from the 81 metre flagpole is 12.8 m by 6.4 m, about the size of half a tennis court.[] The flagpole weighs 250 tonnes and is made of polished stainless steel from Woolongong. It was designed to be the pinnacle of Parliament House and is an easily recognisable symbol of national government. It is visible by day from outside and inside Parliament House and floodlit at night. The flag itself weighs approximately 15 kg.

The building was designed to "sit above" Old Parliament House when seen from a distance. It was proposed originally to demolish Old Parliament House so that there would be an uninterrupted vista from the New Parliament House to Lake Burley Griffin and the Australian War Memorial, but there were successful representations for preservation of the historic building, which now houses a parliamentary museum.

The original idea was for Parliament House to be open freely to the public, and the sweeping lawns leading up to the entrances were intended to symbolise this. The building is a major visitor attraction in Canberra with about 1 million visits each year.[] With the increased risk of terrorist attacks in recent years, the security of Parliament House has been increased greatly. One result has been the construction of crash barriers blocking vehicular access to the lawns.

Layout

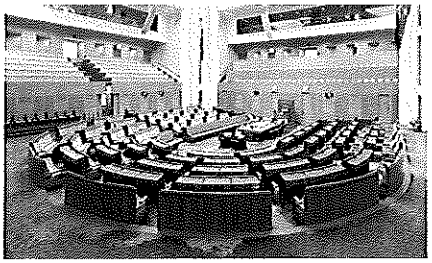
The public entrance to Parliament House opens into a main foyer leading into the Great Hall, which features a tapestry based on a painting by Arthur Boyd, the original of which is also displayed in the building. Functions that have parliamentary and federal relevance often take place here, but the Great Hall is also open to functions for the general public, such as weddings, and the nearby University of Canberra hosts graduation ceremonies here.



The Great Hall in Parliament House. The tapestry at the rear of the room is an enlarged version of an Arthur Boyd painting, and at 20×9 meters is one of the largest tapestries in the world.

Below the tapestry of the Great Hall is a removable division which opens on to the Members' Hall, which has a water feature at its centre. This is an area restricted to security-classified occupants of the building and special visitors. Directly ahead of the Members' Hall is the Ministerial Wing, housing the office suites of the Prime Minister and government Ministers. The Members' Hall has access to the House of Representatives and the Senate buildings to the left and right of the main entrance to the halls respectively. Public access to the visitors' galleries and the Main Committee Room is via an upper level reached by impressive marble staircases ascending from the entrance foyer. There are also 19 committee rooms which are open to the public and a highly secure Cabinet Room on the ground floor.[]

House of Representatives

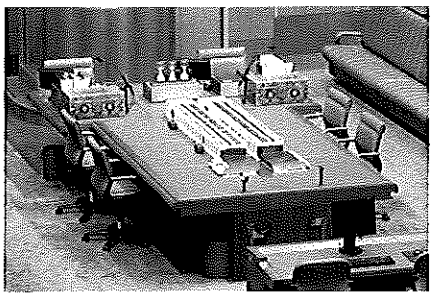


The House of Representatives

In commemoration of the colour scheme of the British House of Commons, the House of Representatives is decorated in green. However, the colour is muted to suggest the colour of eucalyptus leaves.

From the perspective of the image, the press gallery is ahead, with public galleries containing 388 seats[] to the left and right. Soundproofed galleries for school groups are directly above these, as no talking is permitted when the House members are present.

Frontbench (Cabinet) members approach the table with the ornate box (pictured), known as the despatch box, to speak. Backbenchers have a microphone on their desk, and merely stand to speak (unless they cannot stand), in accordance with standing order 60.



A part of the front bench, and the dispatch boxes

Also on the table is a copy of Hansard and where the clerk and deputy clerk sit. The clerk needs to know all the rules of Parliament and is responsible for ringing the bells during a division (voting). In front of the clerk are the hour glasses. The outer glasses measure four minutes and the middle glass measures two. These glasses are turned when there is a division; one of the four-minute glasses is turned and the bells will ring and the clocks will flash green for the House of Representatives or red for the Senate for four minutes. After the hour glass stops, the house's attendants will lock the doors and the whips will count the votes. Members vote by either moving to the government side of the house for a vote for a bill or the opposition side for a vote against a bill. If there is a division soon after another division, the middle hour glass will be turned and the bells will ring for two minutes.

As is the custom with Westminster parliaments, members of the governing party sit to the Speaker's right, and the Opposition sits to the Speaker's left. Independents and minor parties sit on the cross-benches. The long benches (the

front benches) closest to the despatch boxes are reserved for the Cabinet on the government's side and the "Shadow Cabinet" on the Opposition's side.

Senate

The Senate building matches the colour scheme of the House of Lords, decorated in red, but muted to tints of ochre, suggesting the earth and the colours of the outback.

The Senate chamber

The gallery arrangement is almost identical to that of the House of Representatives. Unlike the House of Representatives, only the leader of the government or opposition in the Senate approaches the lectern; other frontbench senators and all backbench senators have a desk microphone. As can be seen from the illustrations, unlike the House of Representatives, there is no distinction between the front and back benches in the Senate chamber; Senate ministers and their opposition counterparts have the same two-seat benches as all other senators. The press gallery is located above the Senate chamber. The presiding officer of the Australian Senate is the President of the Senate. He occupies a position in the Senate chamber similar to that of the Speaker of the House of Representatives. Behind the seat of the President of the Senate are two large seats which are modern versions of thrones. The larger is used by the Governor-General or the monarch (when visiting) when they open Parliament at the start of a new parliamentary session. The vice-regal consort or the royal consort (when visiting) sits in the smaller throne.

Parliament House Solar Power Project

In 2011, the Department of Parliamentary Services commissioned a pilot 43.3kW photovoltaic system on the roof of Parliament House in Canberra. The system is split between two locations, with 192 panels installed on the Senate wing with the remaining 42 panels on the roof of the Gardeners' Compound.[] The panels cover an approximate area of 470 square metres.[] In addition, solar hot water was installed on the premises. The system is expected to produce 65,372kW of electricity every year, with an annual savings of up to $17,000. [] The system will also reduce carbon emissions by 64 tonnes per year. [] At the time of construction, the system was one of the largest installed for solar power in Australia. The Department of Parliamentary Services, conducted a competitive tender process, which selected a bid by Todae Solar [8] and Silex Systems [9] as the preferred tenderer.[]

System Components

The system was designed by Todae Solar[] using Silex Solar Panels (Australian made), Clenergy mounting system and SMA inverters. The systems was installed in 9 weeks from contract signature. Technology and installation:

- 234 Australian made Silex Solar 185W Monocrystalline Panels
- 5 SMA Tripower STP10000-TL inverters
- Clenergy ezRack SolarRoof and SolarMatrix Pro Mounting System
- System Designer - Todae Solar
- Project Manager - Todae Solar

Project Objectives

The Department of Parliamentary Services stated that the primary objective of the pilot program was study the suitability with integration of photovoltaic power and solar hot water into the the existing infrastructure of Parliament House (including how this technology can link to other systems).[]

Completed in 2012, the pilot demonstrated that Parliament House is well suited to solar panels, having large flat roof spaces to capture sunlight and minimal shading. The panels have integrated well into the existing infrastructure and with a low visual aspect, are in keeping with the building design.

System Performance

According to the Department of Parliamentary Services, the system was switched on in June 2011 and has performed as expected by providing enough power for lighting in both the House of Representatives and the Senate.[]. This equates to an approximate saving of $9,000 which is expected to rise to $17,000 annually.

System Awards

The system received an award from the Clean Energy Council in 2012 for ***'Best design and installation of a grid-connect power system greater than 10kW.'***[]

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- Australianexplorer (http://www.australianexplorer.com/canberra_parliament_house.htm) Parliament House tourism site.
- Todae Solar Parliament House Solar Power Case Study (http://www.todaesolar.com.au/parliament-house-solar-power.php)
- Silex Systems Press Release (http://www.silexsolar.com/documents/Silex Media Release - Parliament House.pdf)
- Australian Parliament House Project Page (http://www.aph.gov.au/Visit_Parliament/About_the_Building/Environmental_Management/Solar_panels_project)

Coordinates: 35.308°S 149.125°E (http:/ / tools. wmflabs. org/ geohack/ geohack. php?pagename=Parliament_House,_Canberra&params=35.308_S_149.125_E_scale:5000)

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ATTACHMENT E

Chapter Thirteen

THE NEW PARLIAMENT HOUSE

R.P.S. Dalgleish, ASTC, MIE Aust
assisted by
A.E. Taylder, C Eng, MIMechE (UK), FIE Aust.

Rod Dalgleish began his career at BHP in 1944, as a Mechanical Engineering Trainee. He then worked as a cadet with Newcastle City Council before working on the structural design of Sydney's Eastern Suburbs Railway. After a period with the Snowy Mountains Authority and the Water Conservation and Irrigation Commission, he joined the National Capital Development Commission, being involved with the construction of Scrivener Dam, the bridges, Lake Burley Griffin and associated national works, the gravity main and Corin Dam. He then became Director of Engineering and Housing, Special National Projects and then Chief Construction Manager. In 1980 he transferred to the Parliament House Construction Authority where he was the Project Manager until retirement.

Tony Ewart Taylder commenced his career as an apprentice with Rolls Royce Ltd aero engine division in England, then trained as a pilot with the RAF. Following World War II he worked with the National Coal Board and the United Kingdom Atomic Energy Authority. Arriving in Australia in 1966, Tony has worked with the NSW Public Works, GEC Projects Division and on such projects as Mt Isa mines, Westmead Hospital and Australia's new Parliament House.

WITH Federal Parliament the reason for Canberra's existence, the continued assertion was made that the Parliamentary building should be the city's pre-eminent structure. This aim for pre-eminence, coupled with the extended vacillation on the selection of a site, had a major influence on the engineering considerations and the solutions incorporated in the development.

Walter Burley Griffin's 1912 plan for Canberra located the Parliament House on Camp Hill, a substantial rise on the land axis of the Parliamentary Triangle, some 600 metres north of its apex.

The apex of the Triangle was referred to as Kurrajong Hill in earlier documents and more recently has been known as Capital Hill. Griffin's intent for Capital Hill was for a people's building in a garden setting. It was to be in an extensive hill park environment:

> "for popular reception and ceremonial, or housing archives and commemorating Australia's achievements rather than for deliberation or counsel".

Once it had accepted the City Plan the Government was intent on establishing Parliament in Canberra as early as possible. In 1914, with a view to securing the services of an Architect, it invited submissions for the Parliament building design through an international competition.

The building was to be located on Camp Hill and the design was to provide for staging which would allow the immediate housing of the initial necessary functions, in a form which would later become an integral part of the final completed building.

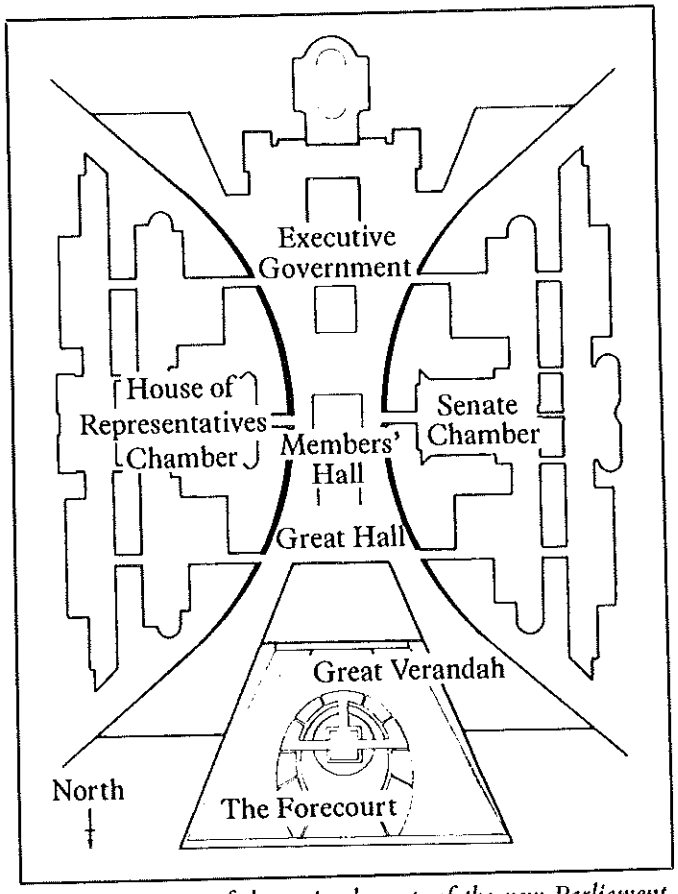


Fig. 13.2: Layout of the main elements of the new Parliament House.

The competition was withdrawn after the start of World War I and when it was reconsidered in 1916 it was postponed indefinitely.

The need to accommodate the Parliament in Canberra re-emerged after the war. By 1921 thoughts were turning towards a temporary arrangement with the permanent building being deferred for many years. The decisions of 1921 and 1922, to establish a provisional building, were to have profound effects on a wide range of uses effecting the subsequent planning and, hence, engineering in the Camp Hill/Capital Hill area.

The site finally selected for the Provisional House was to the north and immediately in front of the Camp Hill site identified by Griffin (and part of the approved City Plan) for the permanent Parliament building.

This decision was made amid inevitable controversy. The departmental advice claimed:

> "The building on this site would enjoy similar central relationship to Canberra as would the permanent building have had"

and that:

> "after use by Parliament the building might be conveniently used as departmental offices".

There was strong opposition to the proposal and vigorous debate. Burley Griffin himself claimed it:

> "would be like filling the front yard full of out houses".

He rightly predicted that it would be a continued default on the approved Plan which would preclude the later construction of the permanent building on Camp Hill.

Other views were that the temporary building should be placed in a position from which it must, of necessity, be removed. While this approach may have given some com-

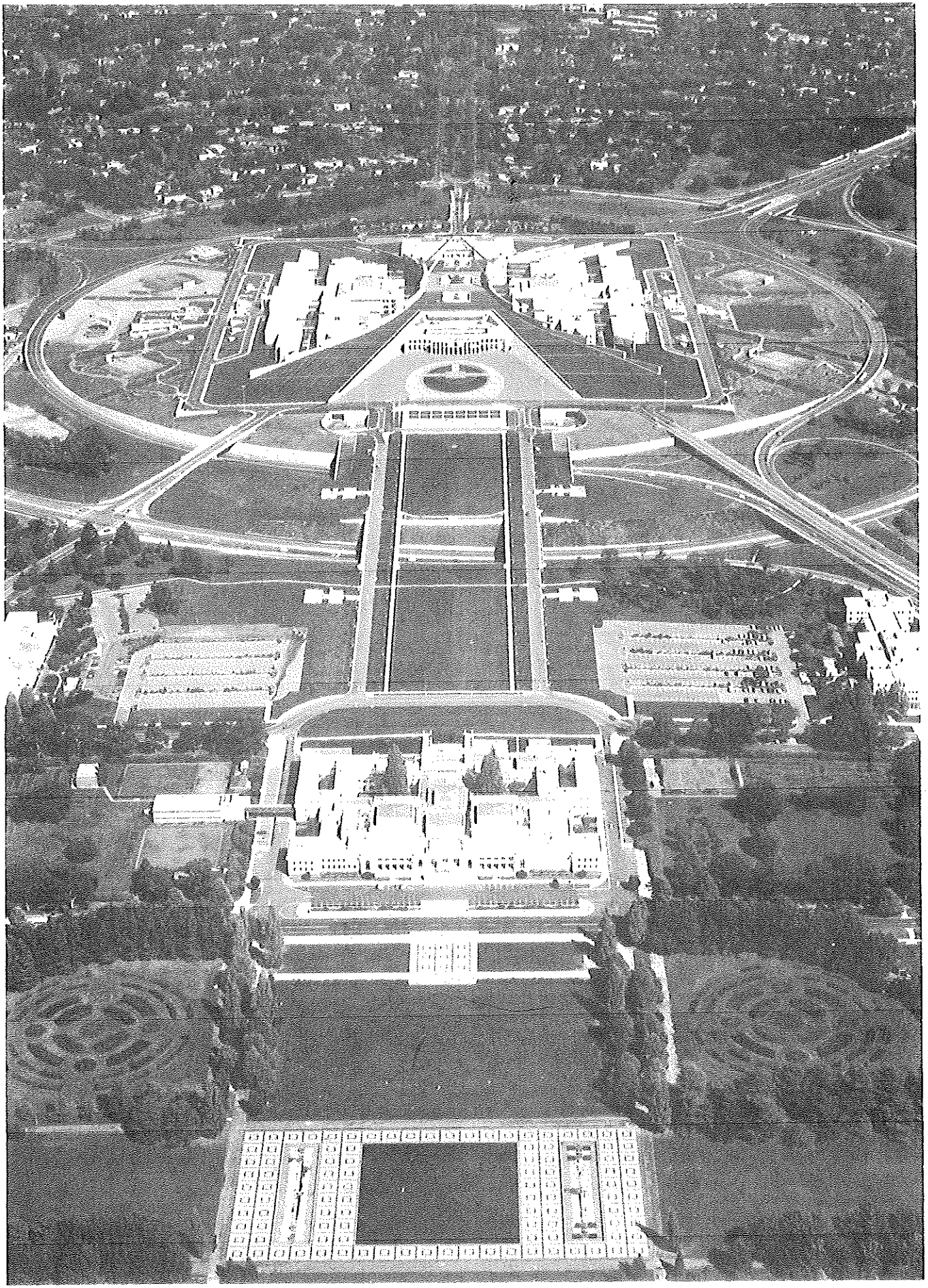


Fig. 13.1: The new Parliament House, with the provisional Parliament House which served from 1927 to 1988 in the foreground.

fort to much of the opposition to the provisional site, there was also a feeling that sentimental and historic interests would cause the temporary building to remain for all time.

As is history, the Provisional House was placed below Camp Hill, in the knowledge that this left both Camp and Kurrajong Hills free for later consideration for the permanent building. This temporary building, completed in 1927, progressively became a symbol to Australia, developing its own identity and character.

Selection of the Site

By the mid 1950s, the temporary building was under great stress to meet the present-day needs. Also emerging were pressures for a more co-ordinated and energetic development of Canberra as the National Capital. In view of the Government's concerns and the September 1955 Report of the Senate Select Committee, Sir William Holford was engaged to provide 'Observations of the Future Development of Canberra'.

From the Holford Reports (1957) came recommendations to:

- construct Lake Burley Griffin in its present form
- locate the permanent Parliament House on the lake shore, rather than Camp or Capital Hills, and
- to improve the city traffic circulations, to meet modern traffic needs.

Following the Holford Reports and the establishment of the National Capital Development Commission (NCDC) in 1958, planning and development of the Parliamentary Triangle for the next 10 years was on the basis of an approved lakeside Parliament House site.

The removal of the Knoll in preparation for the lakeside site (Figure 13.3), general upgrading of Parkes Place, construction of the National Library, development of the High Court and associated access proceeded to approved programmes on this basis. This, however, left the question of what to do with Capital and Camp Hills.

In 1963 the Government agreed in principle to establish a National Centre on Capital Hill, the first building to be the National Gallery. The concept at this stage was basically consistent with the Burley Griffin concept. In October 1967 Cabinet gave approval to proceed with the design and construction of the National Gallery and an architect was selected for the project through a competition.

Meanwhile traffic to the newly emerging Woden area required dramatic adaptation of the Griffin plan at the apex of the Parliamentary Triangle. This led to the construction of the Capital Hill ringroad. The Capital Hill site became an isolated small hill about 30 metres high inside a 640 metre diameter arterial ring road. While this proposal was consistent with a National Centre it was inhibiting for a building complex such as Parliament House.

Paradoxically, proposals were developed around this time for a full size replica of Captain Cook's ship *Endeavour* to be placed on Capital Hill to commemorate the Cook bicentenary. Concurrently, planning continued for Parliament House to be sited on the lake edge in Parkes Place and for it to be partly surrounded by a moat. Incongruous as this may seem, the logic was that the *Endeavour* was to be part of the Maritime Wing of the Museum Section of the National Centre; Parliament House would incorporate a ceremonial access by barge along Lake Burley Griffin from Government House.

In August-October 1968 renewed debate in Parliament led to planning for the Parliamentary Triangle being thrown, once again, into confusion. The lakeside site was ultimately rejected and alternate sites were to be investigated by a Joint Standing Committee.

In May 1969, following these investigations, the Senate voted for Capital Hill and the House of Representatives favoured Camp Hill. The Government decided on Camp Hill. Once again planning in the Parliamentary Triangle was revised and further works committed on the basis of the revised plan.

This decision did not, however, resolve the question and after a further report, in August 1974, a Joint Sitting of both Houses of Parliament finally resolved the site. This time it was to be on Capital Hill.

This decision allowed the development of the Parliamentary Triangle, and particularly for the new Parliament House, to proceed more confidently. The site selection, however, raised a range of design problems for the engineering, as well as those foreshadowed in the reports to Parliament for the architectural and planning aspects.

Without detracting from the imaginative solution developed by Mitchell/Giurgola & Thorp, the Architect for the

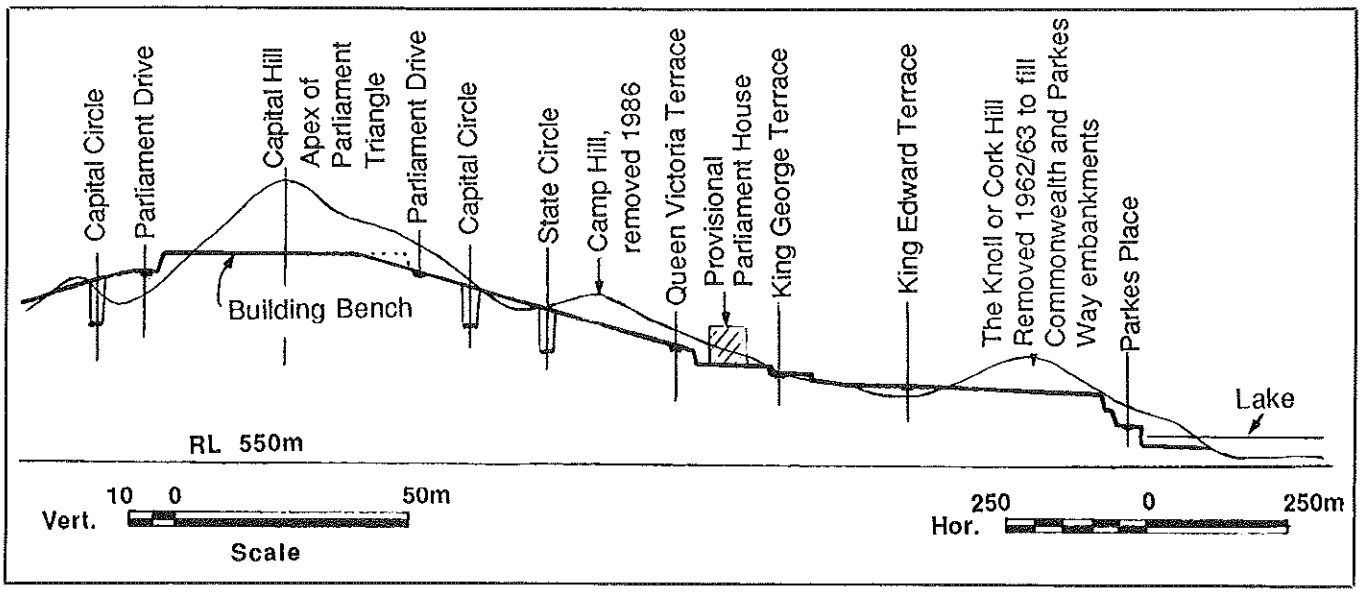


Fig. 13.3: Longitudinal section of Land Axis, showing original landform and grading at 1988.

new Parliament House, future generations may debate whether this decision may have downgraded the Griffin concept. It certainly led to the fragmentation of the National Centre, with components scattered throughout Canberra, and saw the total removal of Camp Hill.

DECISION TO PROCEED

By the 1970s the Provisional House was completely inadequate for the needs of contemporary government, despite having been extended to more than twice its original size.

In August 1975 the 29th Parliament established a Joint Standing Committee (JSC) to act on its behalf on all matters concerned with the planning, design and construction of the new Parliament House. It provided NCDC with functional information for incorporation into user requirements which would be the basis for NCDC's planning, design and construction of the project.

The first report of the JSC, dated 30 March 1977, favoured a two-stage development and concluded that it was both feasible and practical for the first stage to be completed by January 1988, in time for Australia's bicentenary. After further work on requirements for the brief, the proposal was consolidated to a single-stage development, with provision for future extensions.

The JSC's third report to Parliament, in May 1978, stressed that for the 1988 date to be achieved the Government had to be committed to proceeding with the project by November that year. This report also recommended on the method for selecting the Architect.

Debate on the merits of the new House *vis-a-vis* yet further extension to the Provisional House, continued throughout 1978. Finally a Cabinet Ad Hoc Committee was appointed to review the brief requirements and to consider whether a decision really needed to be made by November 1978.

Subsequent meetings of the Government and Opposition Executives supported, in principle, the construction of the new House and on 22 November 1978, Prime Minister Malcolm Fraser announced that the new House would proceed, at a cost of $151 million (May 1978 prices).

The Government:

> "because of the tight time frame for the project and economic conditions at the time"

decided to establish the Parliament House Construction Authority (PHCA) under the chairmanship of Sir Bernard Callinan. PHCA, under the PHCA Act 1979, was to design and construct the new building. It was to work in close liaison with, and use the resources of, NCDC and the then Department of Housing and Construction (DH&C).

The NCDC compiled the comprehensive user requirements and developed documentation for the competition to select the Architect. This was followed by a number of studies including engineering and specialist services. These reports formed part of the ultimate briefing of the selected Architect.

DESIGN COMPETITION

The project Architect was to be selected through a two-stage competition, with PHCA member Sir John Overall (the former Commissioner of NCDC) Chairman of the Panel of Assessors.

On 5 April 1979 Parliament cleared the first-stage competition documents and Australian registered architects were invited to register for the competition. When registrations closed on 31 May 1979, 961 applications had been received.

Stage I documents, requiring an initial concept for the building, were issued and 329 entries were received by the 31 August 1979 closing date. From these entries the Assessors selected ten: five finalists to be engaged for the second stage and five prizewinners whose work was recognised but who would proceed no further in the competition.

The finalists were: Bickerdike Allen Partner (London), Denton Corker Marshall Pty Limited (Melbourne), Edwards Madigan Torzillo Briggs International (North Sydney), Mitchell/Giurgola & Thorp (New York) and Christopher Waite (British Columbia).

They were brought to Canberra for two weeks in November 1979 and were briefed on the operations of Parliament, the planning of Canberra and the proposed management of the project.

They then had six months in which to develop a much more detailed submission, including models. These submissions were of necessity still only in the concept stage.

The Assessors reassembled on 9 June 1980 and after a week were firm in their views on the submissions. Over the next week they sought advice from many government specialists and consultants on the workability of the designs. On 26 June 1979 PHCA announced the competition winner was the firm of Mitchell/Giurgola & Thorp (MGT), with Richard Thorp the nominated architect.

SELECTION OF CONSULTANTS

In parallel with the architectural competition, PHCA considered options for implementing the work. The NCDC, in submissions to the Authority, favoured a project management/construction management approach, rather than lump-sum contracting. PHCA decided to seek the views of industry and through nationwide advertising invited submissions which described procedures the respondent felt would best meet the time and cost targets and which also detailed the respondent's experience, qualification, organisation and personnel able to be involved in the project.

Sixty-four replies were received. They were from a broad range of individuals, associations and groups in the design and construction industry. They represented an extensive range of backgrounds and experiences.

The submissions were reviewed and analysed by a panel comprising senior officers of NCDC and DH&C. There was almost total agreement in the submissions on the need for a project management type arrangement but there was considerable variation in the advice about the relationship and responsibilities between the Architect, Project Manager and Construction Manager.

The submission of the Association of Consulting Engineers Australia best summed up the theme common to most of the submissions and reflected the earlier advice from NCDC:

> "The Association is of the opinion that the public interest will be best served in respect to cost, quality, time and opportunity for participation by the following means:
>
> 1. Project management by either an 'inhouse' project management group of personnel employed by or seconded to the Authority or by commissioning an independent professional practice for the purpose.
> 2. Design, documentation and technical construction phase services by the competition-winning architect and various specialist architects, engineers, designers and other experts. They would provide services in accordance with briefs by the Project Manager who would also monitor and co-ordinate them.
> 3. Construction by various contracts as determined and programmed by the project manager and let by com-

petitive public and selected tendering procedures. Supervision, contract administration, site co-ordination, industrial relations and construction site services by a Construction Management Division of the Project Manager or by a separate independent Construction Manager to be briefed and monitored by the Project Manager.

None of the parties described above, except the contractors, should have any commercial interests which may in any way affect their independence in serving the Authority."

All respondents accepted that the conventional system of sequential design, documentation and construction through a lump sum tender was inappropriate and impractical for the extent of work to be carried out in the required time frame.

The review panel reported to PHCA in September 1979, opting for a project management system. It recommended that:

1. PHCA, as a matter of urgency, appoint an Executive Officer and a Project Manager.
2. Immediately after the appointment of these officers PHCA procure the services of a Construction Manager, Project Planner and Cost Planner.

The report detailed the responsibility of various positions and consultants, as well as suitable firms which could be interviewed for the consultancies. The DH&C and NCDC would provide resources, advice and service as required.

The Authority accepted the recommendations and quickly appointed its Chief Executive (Gordon Peatey) and Project Manager (Rod Dalgleish). Interim agreements were made with a Construction Manager, Project Planner and Cost Planner. This enabled advice to be given to the Assessors on constructability, materials, program and costing of the Stage II competition entries and to quickly establish a realistic budget following announcements of the competition winner. It also allowed preplanning of work to get underway.

Advice from this group was incorporated into the Authority's July 1980 Report to Government, resulting in Parliament giving the project approval to proceed in August 1980, with a revised budget of $220 million (May 1978 prices). This budget was for building only and did not include fitout and furnishing which is normally undertaken by Government services departments.

Following Government approval, the Architect (and his nominated design consultants), the Construction Manager, Project Planner and Cost Planner, were briefed and engaged for work on the project. Engagement of other specialist consultants was made as required as the work proceeded. At the end of this Chapter there is a full list of these consultants.

CONSULTANTS' ROLES

PHCA, in undertaking the project management role in-house, was intent on keeping the Authority to a small, efficient, expert but flexible management organisation using agents or consultants for the professional services, with construction being undertaken through publicly tendered contracts.

The project consultants were developed into a closeknit multidisciplinary team. The Project Manager, while providing leadership and direction, worked within the project team at peer-level to maintain a high level of interaction, informal communication and co-operation. Active encouragement was given to the particular abilities and flair of the various parties, to cross-fertilisation of ideas and contribution to the team effort, while working within accepted parameters of performance, time and cost.

To ensure this profitable interaction, the briefs of the major consultants were circulated to the other main team members. This ensured there were no gaps or overlaps and that the various phases of the work were fully integrated. Any concerns raised by the various teams' members were resolved at this stage so that there was full agreement and acceptance of the requirements by all team members before contractual agreements were formalised.

While above 75 per cent of the project contained a predominantly engineering discipline, the work was essentially of a multidisciplinary nature. It involved a broad range of consultants and required free interaction between all parties, including the user, to ensure a balanced, high quality functional product within the Architect's design intent.

The Architect (MGT) fulfilled the normal design role through to the tender stage. The Architect engaged his own design consultants and co-ordinated their work within the overall framework of the approved design. Construction services were, however, adjusted to that of ensuring the integrity of the design and to provide professional advice and service to other team members.

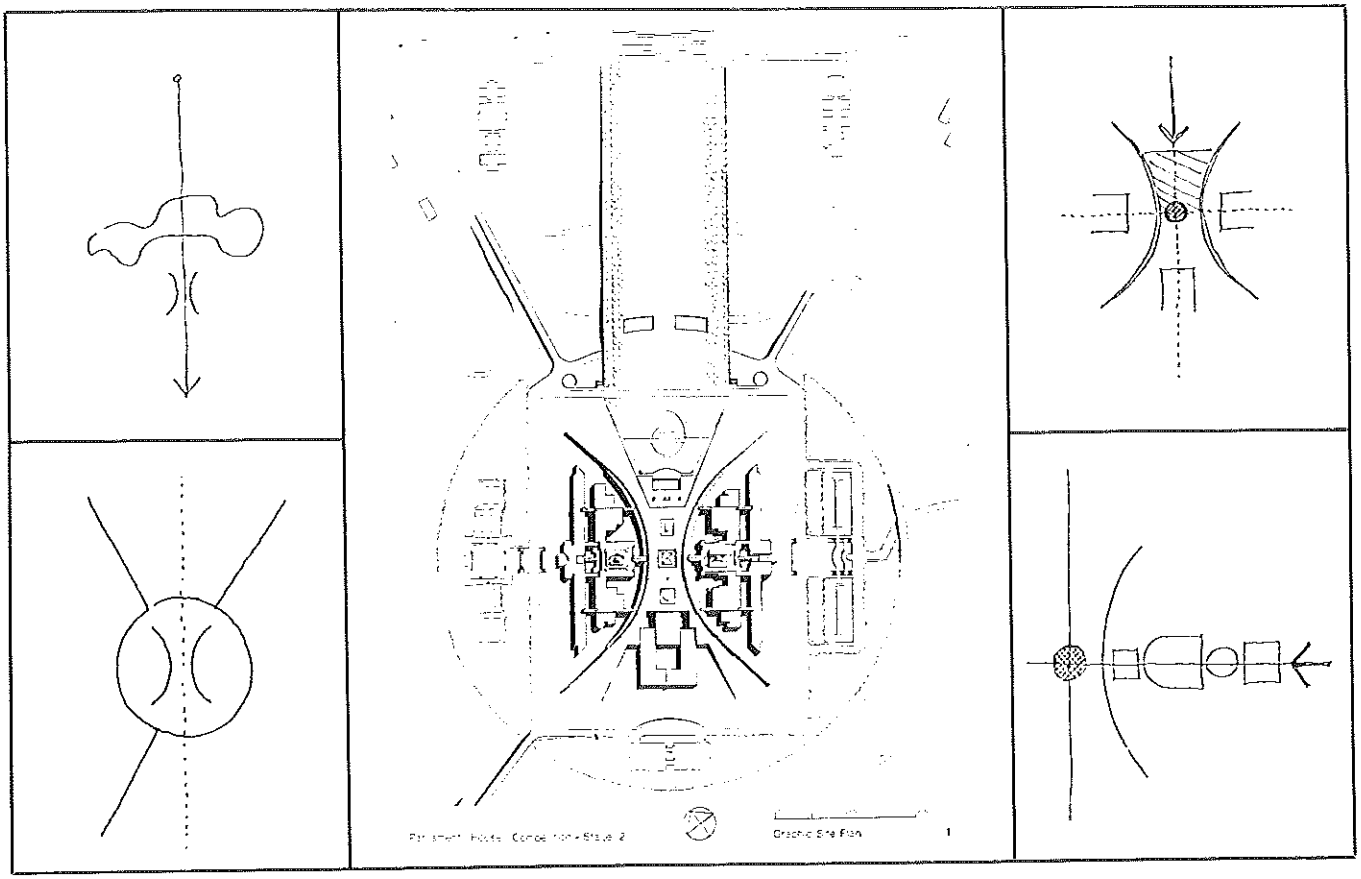
The Construction Manager was a joint venture between two leading construction firms, Concrete Constructions and John Holland. Known as Concrete Holland Joint Venture (CHJV) they were engaged as a consultant rather than a builder or contractor. In this role they were better able to function as an equal within the project team, providing building advice and service to the design agents, with responsibility to PHCA. The Construction Manager assembled the tender documentation, assessed and recommended on the tenders and supervised construction as 'Superintendent' for the contracts awarded by PHCA. The Construction Manager also provided, on PHCA's behalf, the necessary establishment and common facilities such as site security and cleaning, workmen's mess and toilet facilities, hoisting, water supply, access and the like. The items of establishment were provided through tendered contracts but the Construction Manager, although a builder, was not permitted to tender for any of these works.

The Project Planner (McLachlan Group) provided advice and service to PHCA on the development review and reporting on project programs at various levels; to the Architect on design activities; and to the Construction Manager on the detailed construction and integration, with the information supply from the Architect and other agents. Advice was also given on establishing PHCA's computer system and on cost control services in the latter stages of the project.

The Cost Planner (Rawlinson & Roberts) developed and controlled the cost plan for the project, providing advice and service to the PHCA, Architect, Construction Manager and Project Planner. This was a cost engineering-type role, rather than the separate quantity surveying service provided directly to the architect.

The PHCA required all major consultants to be located and work in Canberra. Endeavour House, in nearby Manuka, was taken over for the design groups while management, planning and construction were located on the site.

A broad range of consultants was used to provide advice and service, and sometimes physical work, on security, building, weather and waterproofing, fire services, wind, sound, vision, communication systems, graphics, furniture and the like. The list of consultants at the end of this chapter shows the range of disciplines used and places the engineer-



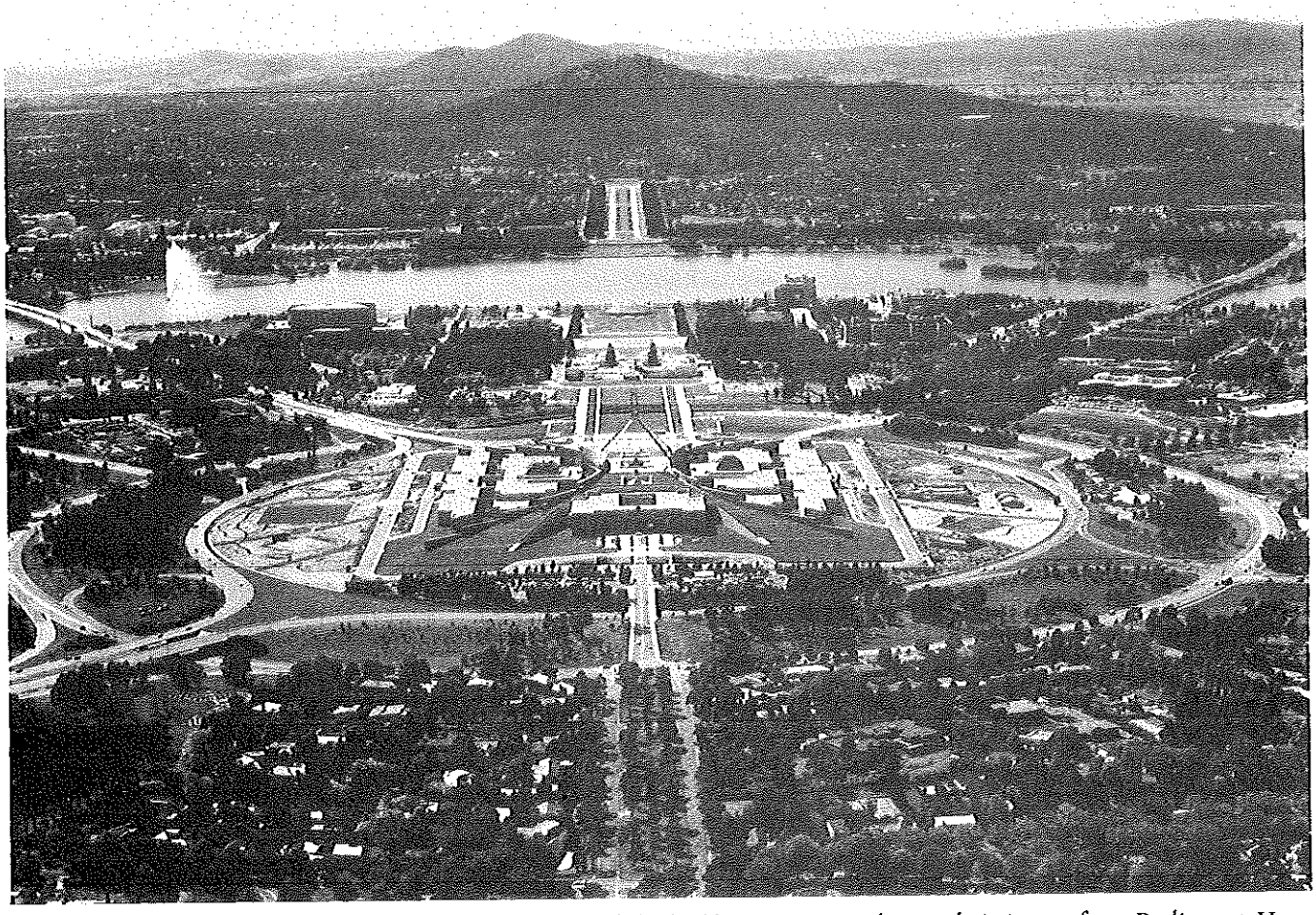


Fig. 13.4: The diagrams above, showing the relationship of the building concept to the Land Axis, are from Parliament House Competition Stage 2 entry No 177 by architects Mitchell/Giurgola & Thorp. The Land Axis is shown in the picture below, looking across the new Parliament House to Lake Burley Griffin, Anzac Parade and Mount Ainslie.

ing advice received into the context of the whole project.

Artwork and furniture were provided through a similar arrangement by PHCA's External Relations/Co-ordination Group, using extensions to existing consultancies or under new agreements where that was more appropriate.

DESIGN

The Concept

MGT's design concept incorporated many of the visual objectives of the Griffin Plan for Capital Hill. It was an ingenious solution successfully arranging the planning, architectural and function requirements of a very large building on an extremely difficult site, while in appearance remaining consistent with Griffin's intent.

The concept was simple in that:

- the land axis was the key element in the composition
- the two chambers were located symmetrically on either side of the land axis on a cross axis through the central hall
- support areas and offices were positioned around each of the chambers
- ceremonial, public, common areas, committee rooms were located along the land axis.

The plan effectively devolved into three, perhaps four, logical zones:

1. the Central Zone along the land axis, which
   a) incorporated public areas, restaurants and common facilities to the north of the central hall; and
   b) incorporated Cabinet and Committee rooms, Executive area and Library to the south.
2. House of Representatives Zone to the east.
3. Senate Zone to the west.

The planned layout maintained clarity of function and grouping for easy comprehension of the concept's essential simplicity.

The Central Zone is contained within two large curved walls. It is grass-covered, which gives the effect of retaining the hill and providing an approximation to a people's building in a garden setting, as envisaged by Griffin.

The office wings are kept to two and three-storey height so that the building is sensitively adjusted to the terrain, rather than imposing upon it.

The two Chambers and associated offices are located on the transverse axis, forming a logical progression from the Representatives and Senate entrances through the Presiding Officer's suites, vestibules, lobby areas and Chambers to the Members' Hall of the central zone.

Identification and reinforcement of the apex of the Parliamentary Triangle was essential for the concept to succeed within the city plan. This was achieved with the Flagmast, ethereal in appearance, through fine design and choice of material, surmounted by a continuously flown national flag.

Provision for future growth was identified in the arrangement of the office layouts, while additional space was incorporated in the more rigid central spine, which could not be readily enlarged later.

The building has four front entrances: the main entrance to the north, Executive to the south, House of Representatives to the east and Senate to the west. Without a 'back door' the receipt of goods and despatch of waste occurs at basement level through a series of service tunnels to an external loading dock remote from the building complex. Access to the loading dock is independent of the main building.

The winning design, although conventional in technology and materials was different in that it required such a high quality finish to be achieved across a broad range of activities. Particular attention was necessary to raise the normally accepted standards of the building industry to those demanded by the design concept. The achievement of this through the materials used, trades, workmanship and construction techniques was a continuing theme throughout the project.

The PHCA Act required the design to be cleared through Parliament at nominated stages. Aspects of particular interest to Parliamentarians and those with visual impact or affecting the Chambers, were cleared through the JSC.

Detailed design was reviewed at working level by the user departments (and within the project team) and was approved within PHCA before being documented for tender. These reviews were undertaken at concept, pencil and final stage.

Approval within PHCA was by the Project Manager where consistent with earlier approvals or through the Design Subcommittee to the Authority for items of significance, those nominated by the Authority or requiring further submission to the JSC. Professor Len Stevens (Dean of the Faculty of Engineering at the University of Melbourne), although not a PHCA member, was co-opted to this subcommittee to provide independent high level engineering advice.

It is pertinent to note that throughout the extensive review process during the competition assessments, schematic and developed design phases and tender documentation, the concept stood up extremely well. It required minimal, insignificant adaptation.

As an indication of size, scale and diversity, the building provides a working environment for 224 politicians and some 3,000 staff, facilities for visiting Heads of State and VIPs as well as annual access to more than one million members of the public.

There are 19 Committee rooms and a large suite of Cabinet rooms as well as the two Parliamentary Chambers, a major Library complex, Theatre, Post Office and shops. Dining facilities range from silver service to cafeteria, catering for about 8,000 meals per day.

For control of the design process, the building complex was subdivided into 25 zones allowing convenient identification of the various parts. Separate design teams developed documentation for logical grouping of zones, allowing a number of areas to advance concurrently. For consistency in design approach across the project, separate co-ordination groups established design continuity and ensured that this was applied logically by each design team. The zoning was also used in the cost planning, programming, commitment, construction and commissioning of the work.

The Structure

The design brief required the use of conventional tried technology and materials consistent with the capabilities of the local industry.

Reinforced concrete was selected as the main structural material because:

- Concrete is well suited to architectural solutions, being flexible and adaptable.
- Attachment of non-structural components, particularly external wall panels, is greatly simplified.
- There was greater potential for economy and rapid construction with a technology common to the ACT industry and capable of pump placement which would relieve pres-

sures on crane hoisting.

- It was more adaptable to 'fast track' documentation through minimising the need for shop drawings in the fabrication phase which are normally required in large numbers with other methods.
- It is inherently fire resistant.

Foundations for the building are on sound rock, mainly Black Mountain sandstone. Some bored piling to rock was used on the western side where the building bench was infill.

The majority of the structure is of traditional reinforced concrete footing, column and floor construction. Post tensioning was used to provide additional stiffness in long-span situations and in localised areas to ensure waterproofing in the water retaining elements. Plate web steel girders were used at roof level to provide long clear spans for the Great Hall, the upper floor in this area is suspended from these girders by a series of concrete-encased hangers. Structural steel is also used in the roofing of the Senate and House of Representatives Chambers.

Design was in accordance with the Australian Standard (Loading) Codes with earthquake allowance at Category 1, due to the long life expectancy of the building. The structural design was undertaken by Irwin, Johnston & Partners, which was led and managed at partner level by John Fowler.

A waffle pan system was adopted for the floor construction to provide appropriate effective depth for structural rigidity and to allow greater clear spans between columns. This system minimised slab weight with the effect of a two-way beam system, yet allowed the use of a simple, quickly erected flat slab formwork technique. It also resulted in a more uniform soffit for underfloor servicing runs for the complex mechanical and electrical service system.

Stiffening near the columns to allow for greater shear was achieved by infilling selected waffle pans. Variability in span was achieved by increasing rib widths between the waffle pans, thickening top slabs and local prestressing

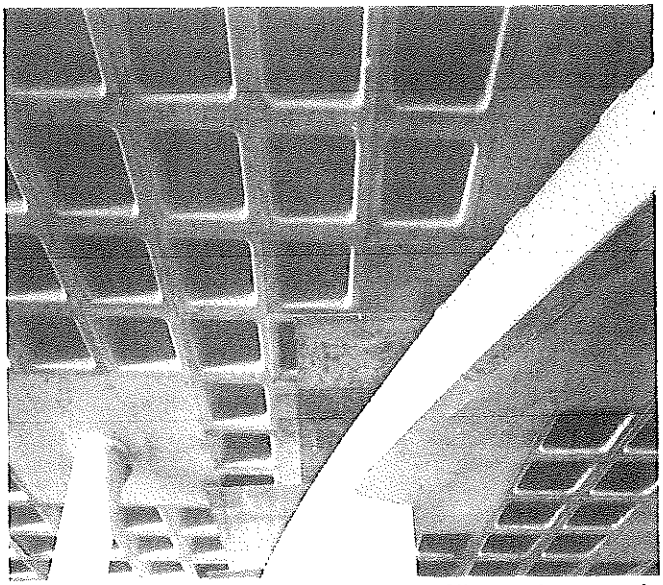


Fig. 13.5: Waffle slab soffit showing infill at columns. The curved beam is the support for the forecourt pool and fountain.

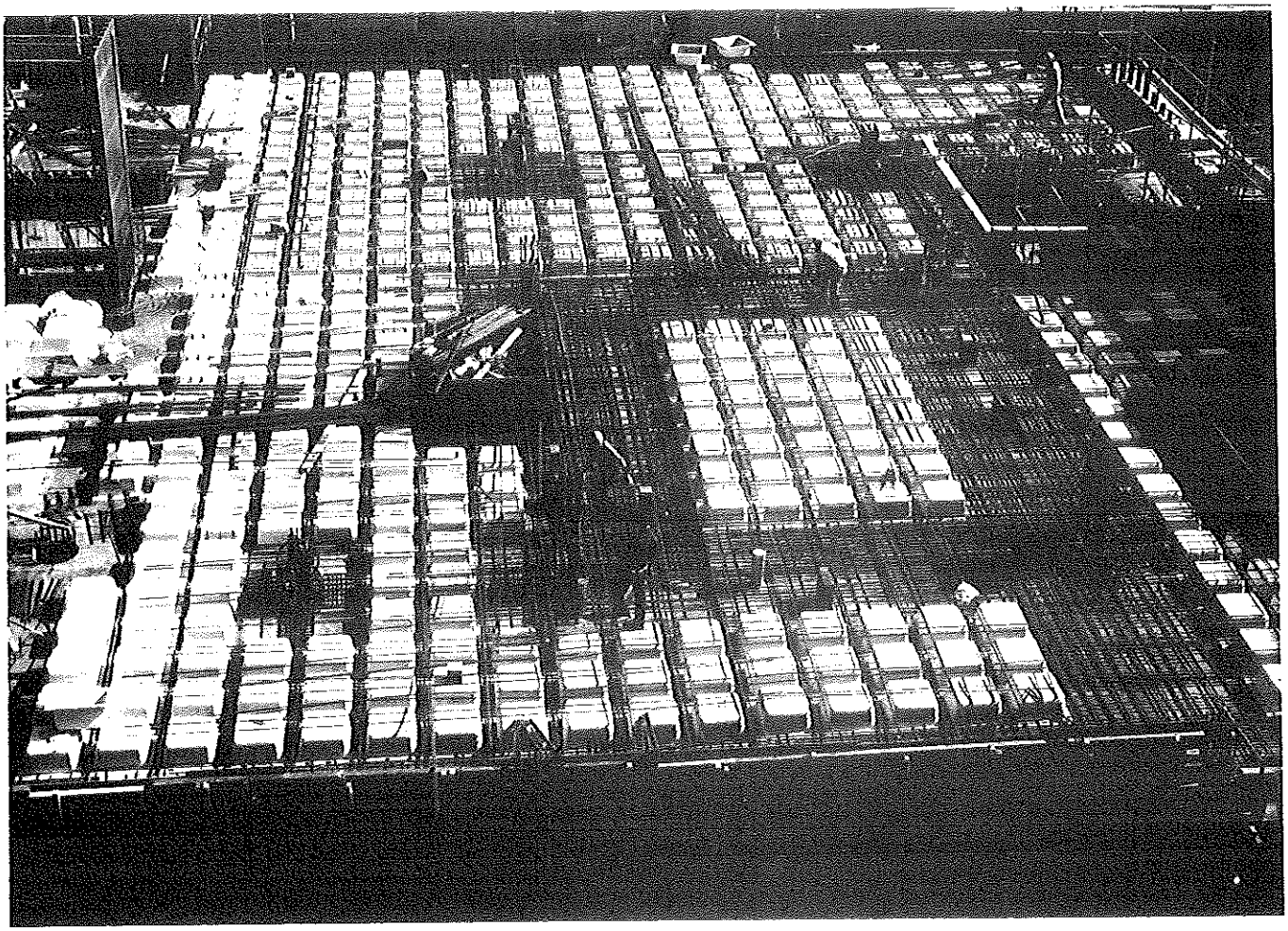


Fig. 13.6: Waffle pan formwork and steel reinforcement.

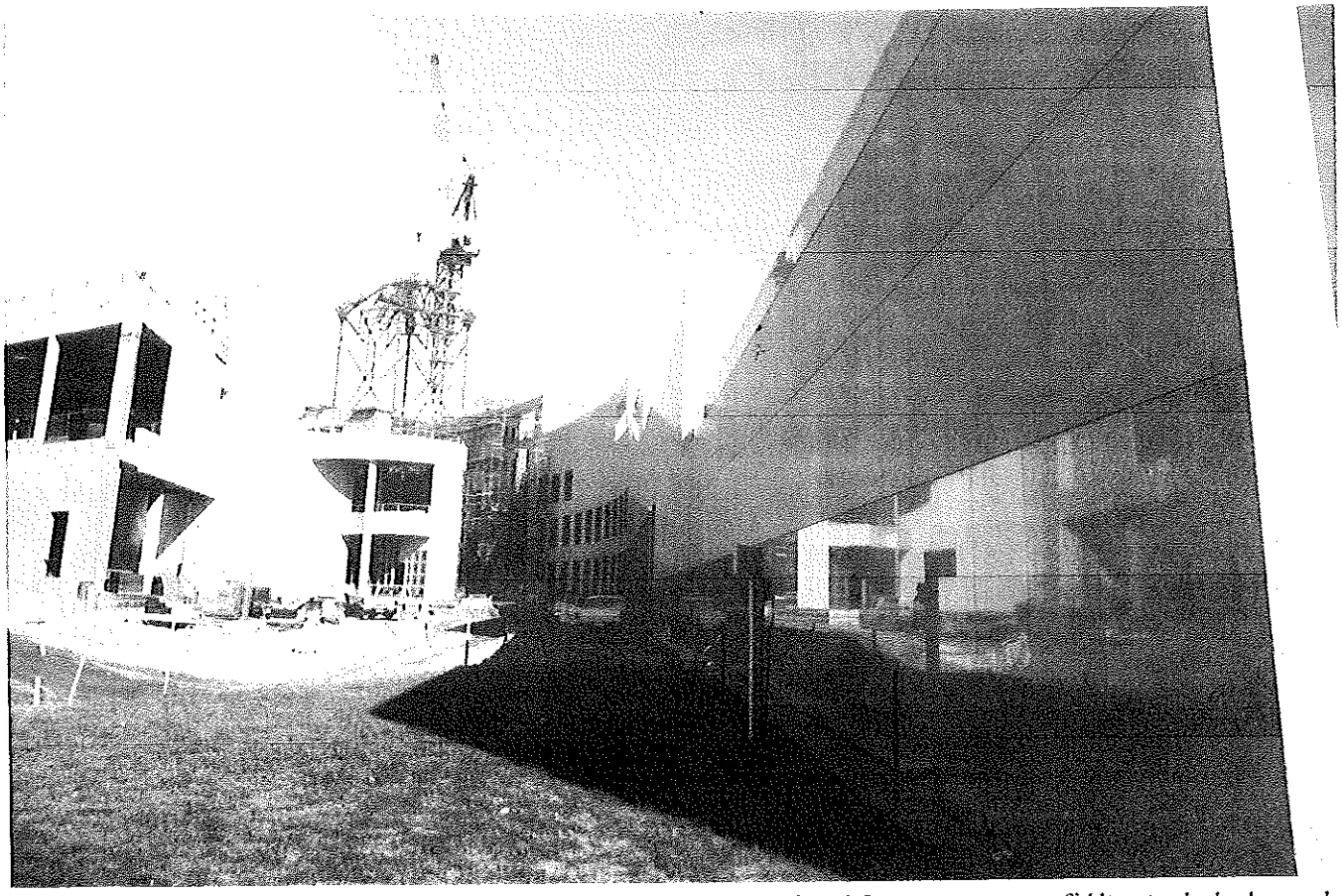


Fig. 13.7: Granite-faced curved wall with the Members' office wing to the left and flagmast erection scaffolding in the background.

where spans greatly exceeded the basic grid dimension.

The waffle system was chosen after detailed evaluation of the structural, building and economic characteristics of a range of fully detailed floor systems. Re-evaluation early in the project development, after feedback from the tendering and construction work on site verified this choice.

The curved walls are constructed with a hollow webbed core containing services, lifts and stairwells. These walls together with the sloping ramps from each corner of the central spine, contained lateral movement and provided long-term stability for the facade and stone cladding.

The unusual horizontal extent of the individual buildings required effective permanent jointing. This jointing on sliding bearings or split column details was provided at 50 to 75 metre centres.

Insitu band beam arrangements, using techniques and layouts common for economic carparking construction, were adopted for the underground carparking structures to the east, south and west of the building. The western carpark, built in a former gully, is subject to substantial unbalanced ground pressures. These are resisted by large prestressed buttresses at close centres, forming a buttress retaining wall on the eastern face.

Cracking of concrete structures had been the bane of building construction in the ACT. This was due to a number of factors previously recognised and to a large extent corrected on buildings such as the High Court of Australia and the Australian National Gallery. With these buildings batching was carried out on site with the full process, including materials, under the supervision of the Design Agent/Superintendent.

Because of the proposed offsite concrete production for the new Parliament House, extensive work was undertaken on concrete technology. Specialist consultants were engaged by the Structural Engineer to report on the status of the materials, concrete batching facilities and practices in the region and to advise on procedures to remedy deficiencies. The design and specifications gave particular attention to:

1. Infill joints throughout the floor and wall systems at about 25 metre centres, to allow shrinkage movements to be stabilised before they were infilled 90 days later.
2. Upgrading the performance of the readimixed concrete industry to Standards Association of Australia codes and guidelines.
3. Careful selection and close monitoring of the aggregate source and handling methods. The majority of aggregate sources within the ACT have, to some extent, minor fracturing and sulphate problems. Performance of aggregates even from the same quarry varied extensively and continual review was essential to ensure materials of quality suitable for a building with a 200-year life.
4. The formwork preparation, reinforcement location and concrete placement. Here the Structural Engineer's role included full quality assurance arrangements and advice to the Construction Manager, to ensure standards were met.

The external wall cladding is granite on the curved central spine. Grit blasted, sandblasted or phosphoric acid etched precast concrete is applied on the office wings, Chambers and Executive areas. Stainless steel was used for attachment angles and bolts, to guarantee long life.

The proposed external cladding and window arrangements for all areas were developed and tested under extreme weather and pressure conditions on a specially constructed prototype with the assistance of CSIRO's technical building service and its specialised equipment.

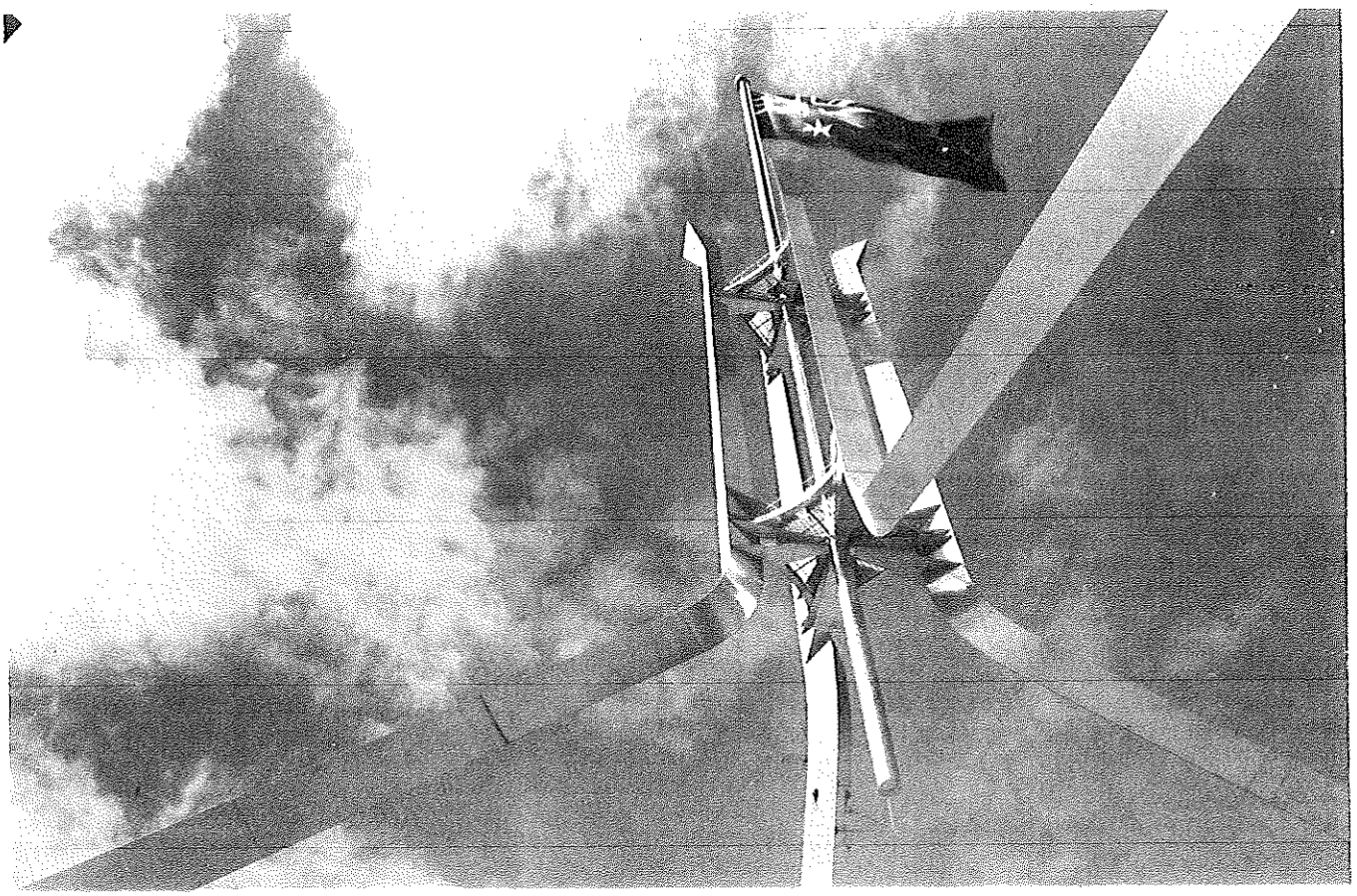


Fig. 13.8: Stainless steel flagmast and supporting legs.

The flagmast structure was intended as a sculpture of symbolic significance, in identifying the cardinal point of Griffin's Parliamentary Triangle, as well as within the totality of the ingenious building concept of Romaldo Giurgola. It towers 75 metres above Parliament and is constructed entirely of stainless steel plate, with a linished finish, providing a changing appearance in the varying patterns of light and weather. The flagmast structure won the Construction Category Award at the 1989 BHP Steel Awards.

The flagmast is supported by a structural tower joining the four slender triangular shaped legs sloping from the top of the curved walls. The flag is flown permanently with the night-time lighting source located in the top of the four tower legs. Maintenance access is via a hoist running on the south-east supporting leg. The flag was originally flown using a series of lines from winches recessed in the top of the eastern curved wall but it was revised in early operation. Control is now from the lower webb cluster of the supporting structural tower, with access via the maintenance hoist.

Waterproofing, particularly of the roofs, has presented serious problems for some major buildings in the harsh, variable Canberra climate. Normal considerations were compounded on Parliament House where the central spine was to be covered by lawn-watered grass and the building has extensive basement and carpark areas below a well-watered, landscaped garden setting.

While the central roof of necessity had to be concrete to support the earth covering, PHCA asked the Architect to give consideration to metal roofing as an option for the offices and Chambers. After considerable investigation concrete was chosen and detailed work then concentrated on achieving effective waterproofing, appropriate roof slopes and effective drainage.

Industry responses to the required membrane system varied and, in spite of in-depth work earlier by CSIRO, reflected the uncertain state of this art in Australia. A major concern was the industry's separation of the supplier from the installer, which compromised guarantees and responsibilities coupled with a low level of expertise and care in installation.

A number of effective modern systems were available; however, most offered an unprotected single membrane type with little history of performance and with long-term durability unproven.

Following protracted investigations and debate, a system using well tried conventional materials with a long proven track record, carefully laid and well protected was proposed. The Authority asked the designers to obtain a second opinion and Mr Robert Moore of ARMM Consultants, New Jersey, provided this service. The CSIRO was also invaluable in its high-level advice and assistance.

An IRMA, or Inverted Roof Membrane Assembly system, was adopted for the project. This consists of a four-layered (ply) high-shear bituminous felt membrane system, progressively built-up on the roofing slab. The membrane is covered for protection with a durable sheeting (Barrister board) followed by rigid waterproof polystyrene insulation topped with a filter fabric. Washed river gravel was placed as surface cover to hold and protect the system over the office areas whilst 0.7 metres of filter and top soil or paving was placed over the membrance on the central spine.

An advantage of this type of roofing is that it keeps the membrane and structure at about the same relatively constant temperature, minimising differential movement — something not achieved with the more frequently used internal insulation. The four-ply high shear system is much

stronger and more reliable than the normally used single-ply membrane.

Below ground waterproofing required a continuous welded bituminous membrane beneath the onground slabs to replace the normal vapour barrier, and Barrister-board protected bituminous membrane on the backfilled walls. The membrane is of high penetration bitumen reinforced with a spun-bonded polyester mat providing high tensile strength and puncture resistance.

ENGINEERING SERVICES

The provision of engineering services was greatly influenced by the unique configuration of the buildings, necessary to fit the landform yet not impinge upon it and to suit the multifunctional, intermittent peak use of the buildings.

By its very nature, the grouping of two and three-storey buildings, spread over a large area in a landscape garden setting required a vastly different approach to the servicing than is common for normal large office developments of a medium to high-rise type.

The main influences were the:

- need for a large number of satellite service facilities with ring interconnections and trunk service runs over vast distances, rather than functionally placed zone service floors
- long horizontal service runs at basement level on trays in service tunnels, access corridors and below-ground crawl spaces, rather than through a neat dedicated service core with easy vertical installation and access
- circulation and transportation requiring a large spread of individual isolated lifts and hoists rather than centralised dedicated lift cores
- hydraulic pressure zoning of individual buildings on a hill site requiring different considerations from the conventional high-rise zoning arrangements
- broad landscape setting with individual self-contained courtyards which introduced urban development type surface runoff and floodway considerations into the conventional building roof and basement stormwater disposing arrangements
- fire evacuation requiring a zoning approach not common to Australian practice. International standards were adapted
- security requirements which were unique and varied considerably over a number of areas, both within and outside the building
- "no backdoor" approach to the design which required an elaborate loading dock access tunnel and basement circulation facilities to cater for the day-to-day servicing of the building.

The services were supplied and installed to "Good commercial quality". Technology was the most up-to-date available at the time of design. With technology advancing so quickly, enforcement of cutoff dates for decisions, to ensure commitment and installation to programme, required a tight discipline.

While further advances may have occurred by the time of commissioning, the project is indicative of state-of-the-art at the time of design. Electronic services were the most affected by technology change.

Services/Energy Management

The services system evolved in light of the latest energy conservation techniques and was applied for operations to be within tight energy budget limitations for most areas of the building.

The main component of the Building Energy Management System is the computer-based Building Monitoring System (BMS). This BMS interfaces with the air, refrigeration, heating, lighting and fire safety systems with a multiplicity of operational modes, optimising the energy use related to the internal and external conditions.

Applications available from the system include:

- lighting remotely controlled to reduce the intensity during unoccupied periods or programmed maintenance and cleaning schedules
- air-handling equipment programmed for the latest possible start-up time compatible with comfort in the various spaces at nominated occupancy periods. Variations in occupancy times for the Sitting and Non-sitting periods, recess periods, public holidays and the like are also programmed
- building cooling cycle programmed to select the mix of outdoor and return air to meet the required cooling load, thus minimising refrigeration requirements from the central plant
- night purging under suitable external conditions to precool the building overnight using cooler outside air. Under ideal conditions the fans may be used on full outside air
- optimising energy use in production and distribution of chilled water which ensures that condenser and chilled water temperatures and flows are best suited to the load requirements and external ambient conditions
- electrical demand and load shedding programmed to minimise peak demand tariff charges
- duty cycling to non-critical equipment items to spread usage on a rotational basis.

Other energy saving modes were considered but could not be justified because of the high capital costs and present or foreseen fuel pricing. They may be reassessed against changing energy conservation and cost considerations. They included:

- thermal storage tanks of about 8 million litres capacity for hot or cold water. These tanks were to store offpeak production of chilled or hot water and recovered heat from the condensing system for use during peak demand periods. (Space has been allowed in the south-eastern ramp basement for installation at a later date should this become justifiable.)
- solar collectors which would be capable of contributing low-grade heat to the presently installed system.

Preventive maintenance was deleted from the Building Monitoring System and is carried out using a Building Operation and Maintenance System installed by the user.

Heating/Ventilation and Air Conditioning (HVAC)

The air conditioning system is low pressure, variable volume with hot water reheating coils on each variable air volume box. Constant volume systems are provided to certain specialised areas (eg computer rooms). High level humidity control is provided to both Chambers, the Great Hall and Members' Hall but not for individual rooms or offices.

Ventilation only is provided to carparking, loading dock, substations, plantrooms and the like. These areas use either mechanical and/or exhaust supply.

The system provides filtered air supply, heated or cooled to nominated temperature. There are twenty-seven variable air volume systems and eighteen constant volume systems plus more than two hundred ventilation/exhaust systems

within the building complex.

Required temperatures are maintained through a pneumatic control system directly from space thermostats. The BMS output is integrated with this pneumatic control system so that it does not obstruct the control system's ability to stand alone. Manual temperature adjustment is also provided in areas such as the Chambers, Great and Members' Halls, entry foyer, Prime Minister's suite and Cabinet/Committee room areas.

Major air handling units are located in nine basement plant rooms. Air distribution from these units is through medium velocity rectangular ducting. Branch ducts are of low velocity to VAV boxes of low pressure (less than 125 Pa).

In the event of fire, the system provides smoke control. With a fire alarm, all air conditioning and ventilation equipment servicing the affected area is switched to the appropriate mode for smoke clearance.

The system is heated and cooled from equipment in the central plant room, towards the southern end of the building spine at basement level.

Hot water (at 82°C) is provided by six low temperature boilers with a total capacity of 12,940 kW. These boilers are gas fired and provide domestic hot water as well as that for the building's heating. Supply and return headers are sized to allow all boilers to operate simultaneously.

Chilled water (at 6.5°C) is supplied by five chiller units with a total capacity of 15,000 kW. Provision has been made for later installation of a further unit of 700 kW. The chiller cooling towers are located in the landscaped bosque outside Parliament Drive and well clear of the building, in order to avoid the winter condensation plume problems of Canberra.

Electrical Services

The power supply system was developed on the basis of four separate 11 kV routes required by the then ACT Electricity Authority. These were located near each corner of the site with the supply to be sourced from Kingston, Lyons and the city. These separated supplies would ensure integrity, flexibility and continuity of supply.

At the time of commissioning and occupation, the permanent supply was from the Kingston substation only, via two of the four nominated routes. Underground conduits have been laid for all four routes, each ultimately with 5/7.5 MVA capacity.

Bulk supply by the ACT Electricity and Water Authority (ACTEW) is via two main high voltage switchboards located in separately fire rated spaces adjacent to the central plant room. Each has the latest type circuit breaking equipment, bus-section isolators and metering.

Internal distribution is initially via three 11 kV ring mains connecting eleven satellite substations and sub-distribution switchboards located near the basement fan and plantrooms. One of these ring mains is for emergency use to provide for essential loads in case of breakdowns and is connected to the emergency generators.

All high voltage equipment in the switchboards, transformers and cabling conforms with that used by ACTEW for interchangeability and ease of maintenance.

Internal low voltage reticulation is at 415 and 240 volts. Reticulation is mainly at basement level in wall and ceiling mounted cable trays with detailed distribution in the ceiling spaces of the building.

Lighting has been provided generally in accordance with AS1680 "Interior Lighting Code". Lighting loads are generally 25 watts per square metre, although this was exceeded in areas of high ceilings, prestige areas and those with specific television requirements. Lamp and source types vary over a range of metal halide, tungsten halogen, and incandescent to meet the architectural requirements in the major areas. Office lighting is generally single or double 40 watt fluorescent in light/air fittings for suites and smaller offices or combined with a grid of air-handling linear slot diffusers in larger areas. Mercury vapour lamps are provided in the corridors.

To minimise unnecessary energy use, major lighting subcircuits have controlled switching from the BMS with emergency over-ride in case of failure. Offices, Members' suites and detailed areas are further controlled by individual wall switches, to meet independent needs.

Emergency power supply for essential services is provided by two 1,000 kVA diesel generators connected to the bulk supply switchboards. Space has been allocated for a further two diesel generators should they be required at a later date.

Ten battery inverter systems are provided for the emergency lighting and the emergency warning and intercom systems, to cover the assessed mains failure period.

Hydraulics and Fire Services

Hydraulics

Water is supplied from connections to two independent city mains in State Circle. Supply to the building is via a 250 mm diameter ring main at Parliament Drive.

The ring main feeds into three radial mains servicing potable water, fire hydrant and fire sprinklers. High capacity fire hydrants are located at strategic intervals around the ring main. Potable and irrigation water are metered at the two diagonally opposite points of connection to the ring mains.

Domestic hot and cold water is connected to some 1,600 faucets throughout the complex. Internal loops are supplied from the radial mains with pressure boosting if required. The one hour recovery hot water calorifier system, with separate pumps circulating closed circuit loops, delivers water at 50°C. Main kitchen supply is boosted to 82°C.

The flushometer system with break-tanks and separate pressure pumps services some 1,000 toilet and urinal installations. This system also charges floor wastes automatically to eliminate permeating odours.

Independent treated water reticulation systems servicing a heated swimming pool, spa bath and 18 water features are also supplied from this system.

Garden and lawn irrigation systems are supplied from the ring main through backflow preventer valves with automatic pumping where necessary for rooftop sprinklers. This automatic irrigation system, using soil moisture sensors, is operated from 18 computerised control centres monitored from a central control room.

Fire Service

An integrated fire protection and life safety plan was developed especially for the building configuration, based on ACT, Australian and International Standards and the requirements of the Commonwealth Fire Board. The building construction achieves at least Type 2 as defined by the ACT Building Manual.

Emergency egress uses both fire stair exits to grade and horizontal exits to refuge areas. The horizontal exit areas (adjacent sections of the building complex) have two-hour fire separation and are smoke protected areas with separate access to grade.

Control of the fire protection system effectively divides the building into four separate regions, each with its own valve station and separate sprinkler water supply coming directly from the external hydraulic service ring main. The building is fully sprinklered except for telephone and electrical equipment rooms.

Each control room contains that region's main fire indicator board, fire fan control panel, control valves and main and standby booster pumps for the various sprinkler systems. Each fire indicator board automatically identifies the source and transmits alarms to the Fire Brigade.

Smoke detection systems of various types are provided in electronic rooms, Members' Halls, Chambers and Library areas and are wired directly to the indicator boards for the region.

Photo-optical-type smoke detectors are provided within the Air Handling System and these are wired to separate sub-fire indicator boards located adjacent to the main mechanical switchboard in each plant room. The sub-boards are wired back to their respective main fire indicator boards.

Superimposed on the fire considerations are the conflicting requirements for security. The building's security system monitors all fire alarms which are displayed on its screen. Egress doors for fire affected zones with electromechanical locks are security released and affected zones are alerted for maintenance of security functions. The system has inbuilt fail-safe provisions to ensure life safety.

Transportation

Lifts and Hoists

While the two/three-storey nature of the project, with generously sized stairways, would normally minimise the need for vertical transportation, extensive use of lifts was necessary. Reasons included:

- basement delivery and distribution of inwards goods requiring hoisting to individual areas, including library, post office and printing offices
- centralised basement kitchens with need for accompanied distribution to satellite kitchens and serving areas
- providing access for disabled and elderly people
- accessing the basement, parking areas and roof increased travel above the three-storey walk-up situation
- controlling access to restricted areas.

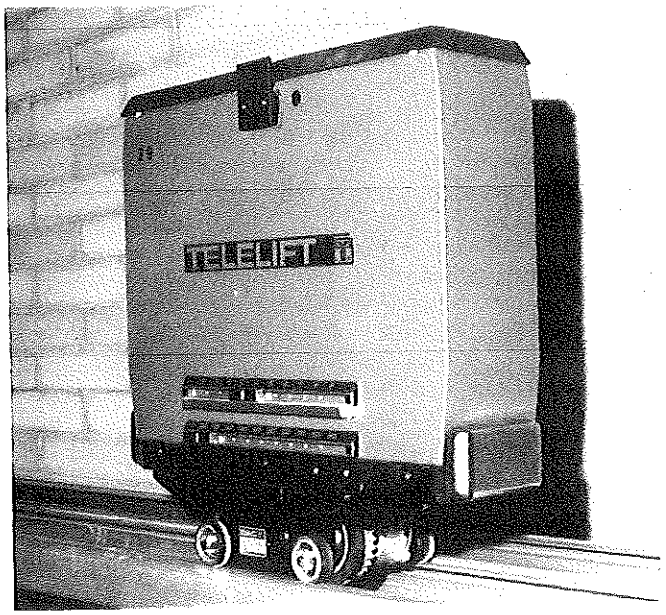


Fig. 13.9: Document movement system car.

Though their main use is for goods transportation, all but one of the 42 lifts are classified passenger lifts under the Australian Lift Code. A few lifts are conveniently grouped in pairs for kitchen service to the Great Hall, dining rooms, cafeterias and refreshment rooms. One dedicated goods lift is provided towards the southern end of the central spine where it can service the furniture store, committee rooms, libraries etc.

Lift motor rooms are located in the basement adjacent to the lift shaft to avoid the normal above roof protrusions. The lifts have variable voltage AC drive. Passenger lifts travel at about one metre per second while the goods lift speed is 0.75 metres per second.

Document Movement

Movement of documents around such a dispersed building requires special arrangements. Two types of Document Movement Systems were installed.

1. The Tracked Container Sysem (TCS) moves documents, mail, books, reports, etc between 32 stations throughout the building. The document containers of 525 mm x 400 mm x 130 mm are mounted on self-propelled trolleys which run on tracks with automatic switching to required destinations.

   Travel speed varies with track configuration but gives an average transit time of five minutes and maximum of twelve minutes between any two stations. Container loads are up to 10 kg. The system capacity can be increased when necessary by adding passing loops, track duplication and additional container units.

   As well, dedicated systems are provided to move documents to both Chambers and for Library use. To minimise movement of attendants in the Chambers a dedicated document transfer system is provided between the sub-table office station behind the Presiding Officer's chair and the Attendant's table at the other end of the Chamber. Quick connection from the second-floor library to the Information and Newspaper Reading Room on the ground floor is essential and this connection, with a travel time of about one minute, is separately tracked in the same shaft and ceiling space as the overall building system.
2. The Pneumatic Tube System gives high frequency and rapid transfer of small documents for Hansard-type purposes. This system links Hansard, both Chambers, Record and Research and the Executive area. The system, serving eight stations in all, is via an 85 mm diameter PVC tube conduit.

   The original pneumatic tube link between the Old Parliament House and the Government Printing Office in Kingston has been extended to an interchange point with the internal system at Hansard in the new building.

Goods Conveyor

A conveyor belt link is provided for inwards goods from the scanning/despatch point in the Loading Dock to the goods receiving area in the basement below the east wing. This 800 mm wide conveyor carries items up to 25 kg each, moving about 2 metres per second. The belt runs in a tunnel beside a narrow carriageway capable of carrying small vehicles and forklift units.

Waste Disposal

Every week an estimated 25 tonnes of waste leaves the building, with about 16 tonnes of it being paper suitable for recycling.

General office waste is disposed of down five vertical gravity chute units with access from each floor. The chutes terminate in basement waste collection rooms where the

material is shredded to uniform size then transported to the loading dock by an automatically operated vacuum tube system. The waste is cyclone separated, compacted and baled at the Loading Dock for despatch.

Classified waste is shredded at source and transferred under security to the Department of Defence's Russell incinerator.

Kitchen waste from an average 8,000 meals prepared each day comprises:

- soft food waste (up to 500 kg daily) which is mulched in 37 garbage grinders and disposed of through the sewerage system
- hard materials (such as bones) which are broken down by compactors and held in refrigerated storage until they are despatched via the Loading Dock.

SECURITY

The user requirements were developed in an environment of escalating international terrorism and followed Australia's first real experience with terrorism, the Sydney Hilton bombing. Whereas in the early 1950s one could enter any section of the Parliament House uninhibited or checked, by the late 1970s many restrictions were in place.

In this changing environment, the new building had to satisfy the conflicting philosophies of open access and satisfactory levels of physical protection. The fundamental principles taken into account were:

- There is an undeniable right for people in a democratic society to observe their Parliament at work.
- It is in the essential interests of all Australians that the democratically elected Members of Parliament are able to meet freely and without fear for their personal safety.
- The operations of the Parliament and Executive Government are not hindered or jeopardised by the actions of unauthorised people.
- The safety of local and overseas dignitaries and internationally protected people visiting the Parliament House is maintained.
- The fabric of the building, classified material, and items of national, historic and Parliamentary significance are protected against theft, vandalism and acts of espionage.

The design of the new Parliament House endeavours to satisfy those principles by differentiating between the levels of security required in various parts of the building and by providing separate circulation patterns within and to these areas.

A prime objective was to achieve the appropriate level of security commensurate with the perceived level of threat, in a cost-effective manner. It was necessary to combine building design with technology in order to contain the high annual operating costs associated with a large manpower component.

The consistent aim was to achieve a range of options based on a low-key, unobtrusive approach with provision for adequate and proper control in areas of special need and provision for a higher level of control at times of increased threat. Security, while being effective, had to give an impression of freedom of movement within the various precincts, particularly in the public areas of the building.

Security Authorities

Responsibility for security in the Parliamentary precincts rests with the Presiding Officers, under the authority delegated by their respective Houses.

In turn the Security Controller is responsible to the Presiding Officers for maintaining security policy, administering security arrangements and co-ordinating protective services. The latter services are provided by the Parliamentary Security Force (PSF) and the Australian Protective Service (APS).

The PSF is responsible for the interior public areas of the Parliament House and for entry to non-public areas of the building. APS is responsible for external security, security of the Executive Government (Ministerial Wing) area and assists, when requested, the PSF with law enforcement within the Parliamentary area.

Security Systems

There are two separate levels of security:

The Public Circulation System covers the Foyer, Great Hall, public facilities, visitors galleries in the Chambers and Members' Hall Gallery, with tourists and casual visitors entering through security controlled check points.

The General Circulation System covers those areas of the building restricted to Parliamentarians and passholders.

A third level, separating the Executive (Ministerial Wing) can be activated readily if required.

Public and general areas security is controlled from an operations room in the northern basement, while that for the Ministerial Wing is controlled from an operations room in the southern basement.

Each control room manages security using a computer-based Central Supervisory System linking four satellite stations, a closed circuit television system, a dedicated intercom system and a two-way radio system. About 2,000 devices are connected to the Parliamentary Security System and 400 devices are connected to the Ministerial Wing system.

Each system can control and monitor doorlocks and door status, receive duress alarm signals, control the closed circuit television system, monitor fire, security and other alarm signals, and advise on action required in response to any alarm. The system can unlock selected locked fire exits.

The security forces also respond to fire alarms. In response to any alarm condition, the security system will display alarm type, location, routes, access details, special precautions, together with detail and overall floor plans on a coloured dynamic graphics display. The operator can quickly assess the situation and initiate action.

The Parliamentary System controls the emergency warning and intercom system, commanding it to issue an alert tone in any one or more of the 49 fire zones, in response to a fire alarm in that zone.

A summary of the overall fire situation is presented on a fire mimic high resolution colour VDU display to keep the building fire warden or Fire Brigade Chief informed of any developments.

The microprocessor-based Closed Circuit Television System has about 180 monochrome cameras, either fixed or pan-tilt-zoom, controllable from either Security Operations Centre, satellite stations, or by the security system. Cameras are solid state or tube type to suit the particular application.

The output of any CCTV camera can be relayed to any screen connected to the system. The security and CCTV systems can be manually operated from any one of the four satellite stations in the event of loss of central control.

Every entrance to the building has a baggage and goods x-ray screening device and walk-through metal detectors.

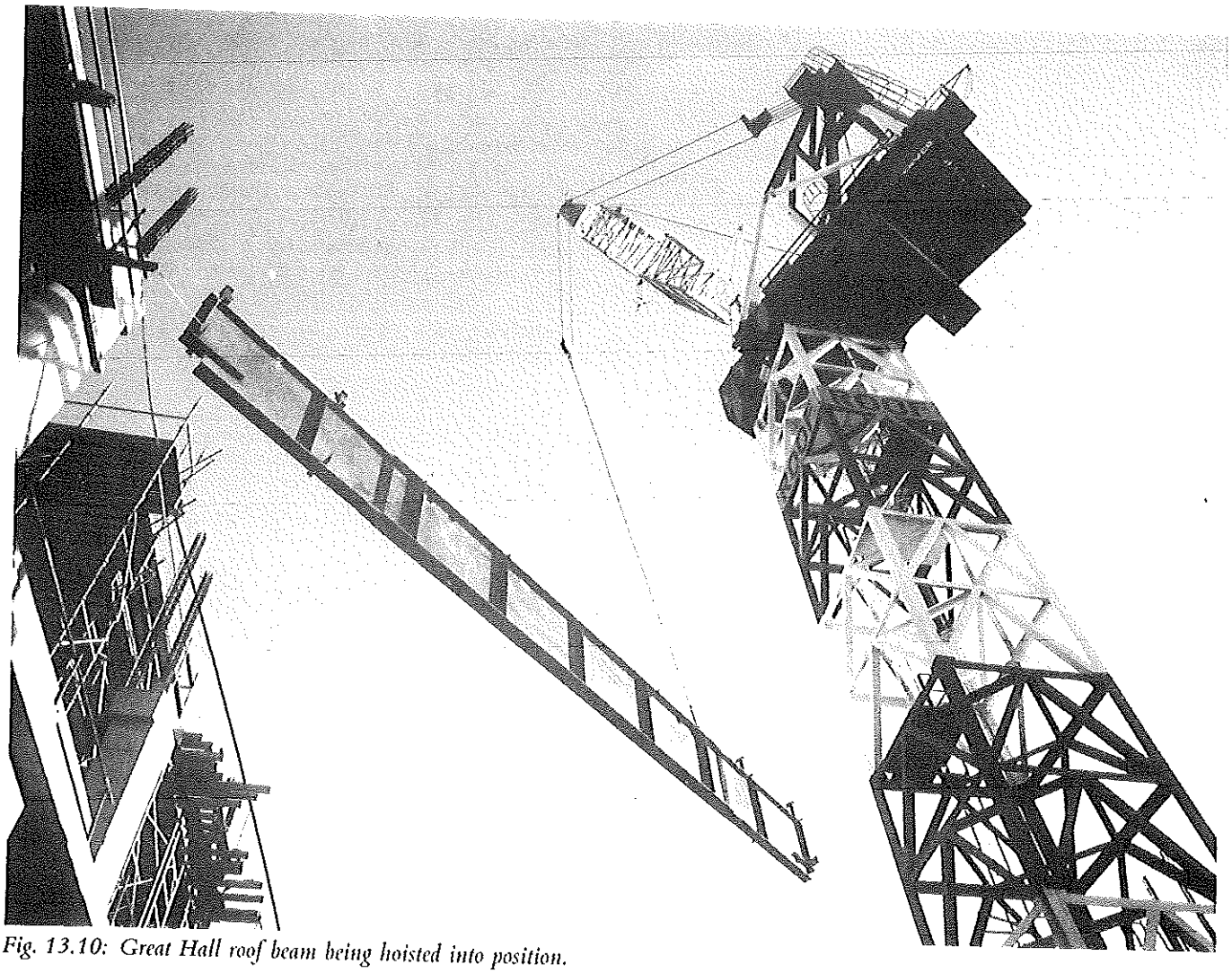


Fig. 13.10: Great Hall roof beam being hoisted into position.

Sound and Vision System

The Australian Broadcasting Corporation was the agent responsible to PHCA for designing and installing the sound, vision, paging and public address systems for the House.

The sophisticated PA system incorporates 12,500 speakers throughout the building and is able to carry the Division Bells, emergency warning signals, the paging service and a localised tourist function.

Speech reinforcement systems, electronically controlled to automatically adjust speakers to give the illusion of voice direction to the person whose microphone is switched on are provided for the Chambers and main Committee Rooms.

Time and notification of Divisions in the Chambers is of prime importance. About 3,000 clocks, controlled by a Rubidium Standard Master Clock System, and featuring Division lights have been installed throughout the building. In recognition of the more-spread nature of the new House, Division bells ring for four minutes, instead of the three in the Provisional House. The system is used as a reference for the television system and for timing speeches in Chambers, Committee Rooms, etc.

The design and building fabric provided facilities for television cameras, microphones and associated control systems in both Chambers and the various Committee Rooms, allowing 'instant' coverage of proceedings in these areas. The system allows predetermined cameras to home-in on the speaker (and the Opposition counterpart) within one second of a microphone being operated.

Camera pickup points installed at prime locations, eg, the Prime Minister's and Ministerial offices, forecourt, theatrette, press conference rooms, allow programme recording or "live-to-air" on-the-spot interviews. Signals can be passed to any of the media bureaux within the building.

The final system will allow full-scale television programme production of network quality with facilities more extensive than the majority of television stations. A 100-channel cable television and FM radio distribution system already reticulates proceedings to Chambers, Committee Rooms and ceremonial spaces, "on-air" television and radio station programmes, "off-air" pre-recorded programmes to in-house television sets or radio receivers.

To provide for hearing impaired occupants or visitors in major public areas, induction loop and the newly developed induction field FM transmitting systems are installed.

In addition, broadband and baseband coaxial type cable information systems networks have been installed. Provision and connection to information system equipment will be by the user, to meet specific and changing requirements.

ACCESS, TRAFFIC AND PARKING

The Parliament Buildings are surrounded by a ringroad. Called Parliament Drive, it serves as a collector/distributor road, fed at a number of points from the city network, and provides access to the four main entrances as well as to the carparks to the north, south, east and west of the building.

This ringroad forms part of the servicing bus route.

Access to the site was initially from Kings, Commonwealth and Adelaide Avenues, via the land axis from Queen Victoria Terrace and from State Circle to the east beneath the bridge on Capital Circle.

There was considerable opposition to the landbridge connection along the land axis by the Presiding Officers for the first years of the project. The eventual acceptance of this connection by the JSC followed the more detailed design of the forecourt and formal approach to the building, coupled with updated traffic circulation patterns. This formal broad, treelined landbridge approach was named Federation Mall.

The Adelaide Avenue connection proved to be virtually unworkable for access to the Lodge, Yarralumla and Deakin areas. It would have caused serious conflict with express bus lanes and merging high speed traffic on Canberra's busiest arterial, particularly during Royal and State visits.

Melbourne Avenue became a far more promising alternative. It resolved these traffic concerns, improved circulation on Parliament Drive and provided more suitable access from the Executive area to the southern suburbs, as well as reinforcing the land axis extension with a symmetrical internal road layout. Again there was stiff opposition within the Parliamentary Committee on the ACT. However, it was overcome in consultation with the JSC, following further development of the original proposal.

The existing eastern connection to the ring road from State Circle was not ideal because of the gradients and sight distances. With the main thoroughfare already accepted, and fully meeting access needs, this then became the "backdoor" access to the loading dock, for which it was ideally suited.

Visitors to Parliament House are encouraged by the road layout to approach the building along the land axis, via Federation Mall. Parking for cars and tourist buses is provided below the forecourt, with easy access to Federation Mall. Stairs lead to the forecourt for an approach across the loosely paved area to the Grand Verandah Entrance.

MGT's competition submission located much of the parking underground, although this was not required by the competition brief. As well as public carparking beneath the forecourt, the priority parking at the four entrances and the western structure, built in a large gully, were also shown as underground.

The brief required parking for 1,900 vehicles, a number which proved difficult to achieve throughout most of the design development. Early in the design stage the forecourt area parking capacity fell considerably short of predicted capacity. The shortfall was overcome by enlarging the western structure. At this stage, surface parking still remained for the south and east of the building.

The original landscape design had the full quota of eight tennis courts on the western side of the House. However, the JSC decided there should be more equitable placement of the courts and half were shifted to the eastern side. To accommodate these courts the parking spaces were placed underground and enlarged to meet requirements. The need to fully meet the parking requirements was confirmed by updated traffic and parking predictions.

Only the southern parking remained on the surface as this had been constructed as part of the early landscape and screen planting and was then used for contractors' parking. All the underground parking has been kept clear of Parliamentary buildings for security reasons, as a result of a car bombing incident at the House of Commons in March 1979, and for fire safety reasons.

When the building was commissioned there was parking for 1,940 cars and 12 buses. The bus capacity can readily be doubled, without additional work.

CONSTRUCTION

General

The project commenced at a time when the building industry was in recession. This had a bearing on some early decisions — the low prices tendered for the standard of work required — and on the union/labour situation as the economy improved.

Completion by 1988 was always extremely tight. Following Government approval to proceed there was a need to quickly establish a workforce on site, obtain necessary agreement with the unions, excavate the building bench and prepare the local industry for a project of such size and complexity. With the lead time required from concept to detailed construction drawings, short cuts were necessary in moving the initial work to the field.

While the American-based Architect organised consultants, established offices in Canberra and finalised the agent agreements, a separate local engineering consultant was used to document the site earthworks from the competition drawings. This allowed the 12-months excavation contract to be placed in the field quickly, with adjustments necessary to suit the detailed building design being accommodated through the schedule of rates contract.

The project was undertaken through publicly tendered lump sum contracts, wherever practical, although use was made of schedule of rates and longterm supply contracts where this was appropriate. Rise and fall was included for contracts over 12 months duration.

Concrete production was originally to be undertaken under close supervision on site. However, with the downturn in the building industry in the early 1980s, most local batching plants were idle and longterm supply contracts which spread the work across the industry, were adopted for employment, cost and industrial reasons. This offsite production did, however, require a detailed appraisal of the technology being used within the industry, which from past experience, contained some questionable aspects.

The spread nature of the building prompted various options being considered for method of construction. These ranged from the use of the ramps at each corner of the building for access to the various levels, to the use of cranes. The configuration of the building, with its extensive above and below ground interconnections, limited access and movement around the site which led to a combination of crane and pump placement of the structure with internal and external hoisting for the fitout and finishing. The large floor heights, spread nature, limitation on access and rate of construction, required eight tower cranes supplemented by extensive mobile cranes to maintain programme.

Building construction commenced with the non-critical underground carparking to the north and west. This approach was adopted as:

- It required minimum distraction of the Architect from the main design task.
- Structural design was relatively straightforward, requiring minimum User interaction and clearances and was able to be issued to the field quickly.
- The carparks were an ideal base from which to establish the longer term supply contracts.

- It allowed a quick buildup of site workforce and facilities, finalisation of union site agreements and a buildup of contractor confidence.
- Being non-critical, the carparks allowed time to solve difficulties and properly prepare the project organisation before the more complex design critical main building elements reached the construction phase.
- Resulted in early provision of stable areas of the site suitable for workers' carparking, offices, messing and ablutions.

Construction of the carpark areas started immediately the foundations were available and proceeded in parallel with the balance of the bulk earthworks.

Documentation for the project encouraged much of the work to be undertaken offsite. Many major components, such as precast facades, structural steel elements, windows, internal joinery and furniture, as well as major plant and electronic items, came from interstate.

Spreading the workload throughout Australia had many advantages for the industry. This was particularly fortunate for the project when the local industry became heavily overcommitted midway through the project. Other work overtaxed the accommodation and resources of the area, causing severe competition for labour, industrial pressures and the inevitable increased allowances and less-than-desirable work practices.

Two decisions on the structure of the building taken after the project was underway had major influence on later construction.

Firstly, in 1981, it was decided to reduce the building height as an architectural and cost saving measure. While significant savings were made through reduced allowances for facades, walls and partitioning, the smaller dimensions between floors created difficulty with installation of services in the restricted ceiling spaces. This quickly absorbed and, indeed, exceeded the initial savings.

Secondly, in 1984, the Parliament decided there should be increased office accommodation for additional Senators and Members. This decision occurred after many contracts had been awarded and much of the work was in an advanced stage of construction. Heavily affected were the services, with the central energy plant well-advanced and many major service runs already installed. Hold orders, redesign, removal or changes to recent and currently installed work with the usual flow-on effects occurred over a wide range of services contracts.

The need to reintroduce the Architect to the office layouts, structure and facades resulted in serious delays as well as some demolition of work and discarding of facade panels. Rescheduling and inconvenient delays to other time critical design works resulted from design teams being redirected to this work.

Deferment of the office enlargement, for later treatment as an extension, rather than to change midstream, was identified as being more cost-effective but was not acceptable to Government.

Throughout the construction policy was to keep a clean, tidy and safe site. The special efforts directed through speci-

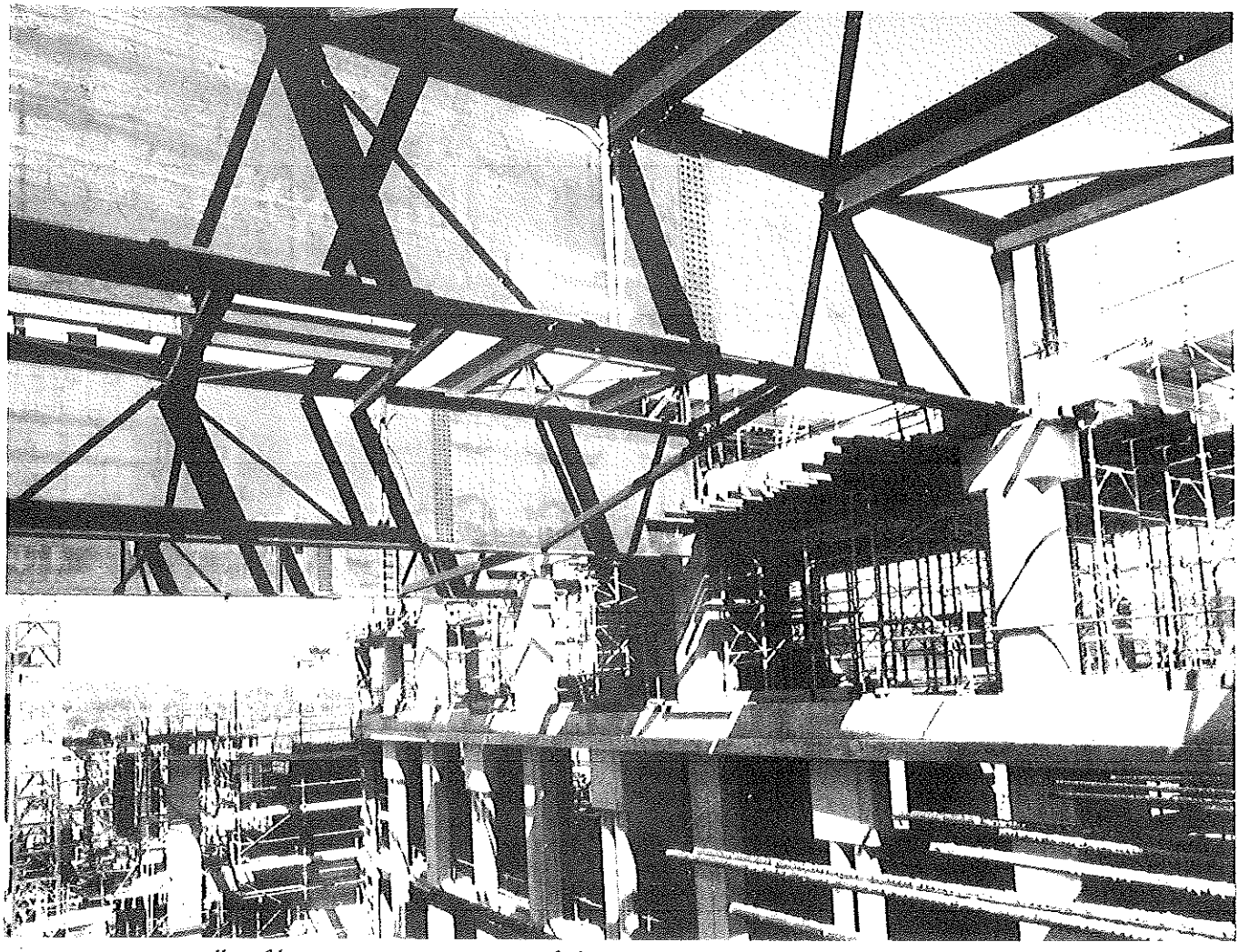


Fig. 13.11: Great Hall roof beams in position prior to roof placement.

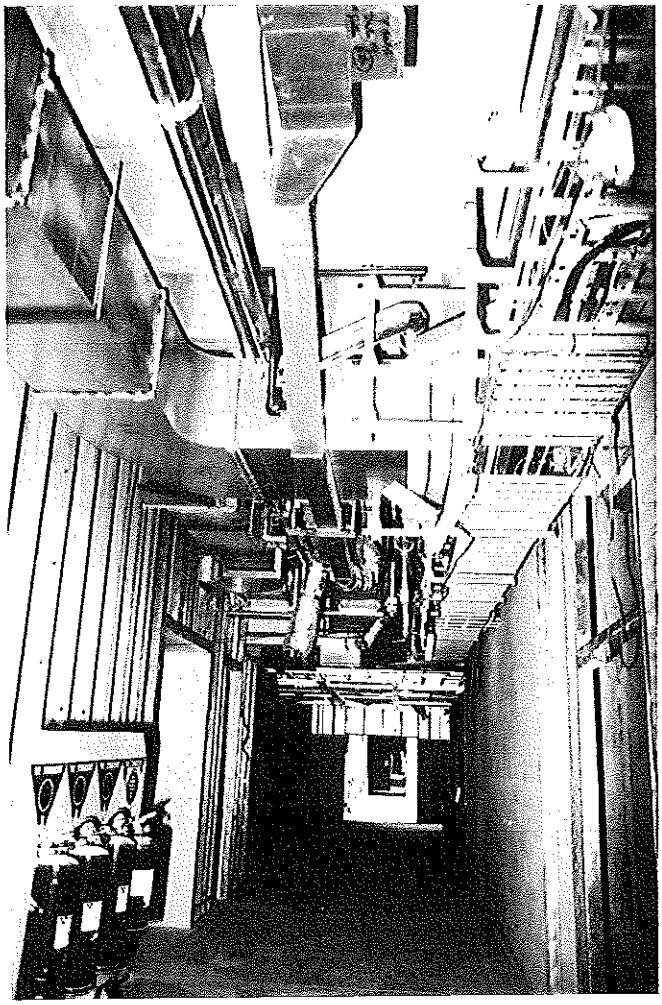


Fig. 13.12: Ceiling services in a first-floor corridor.

fication, education and example toward these separate although interrelated objectives were effective and well worthwhile.

Foundations

Capital Hill in its original state was at elevation RL611.7 metres. The project required the removal of up to 21 metres from the top of hill, to form the building bench at ground-floor level. Basements were excavated a further six metres below most of the building.

The Hill had been subject to extensive investigation work in a number of progressively more detailed stages, from Olik's work in 1958 to the detailed site investigation by Coffey & Partners in 1979. Geological notes on the excavation were made by the Bureau of Mineral Resources during the course of the works.

Essentially, three rock formations made up the site. These were Black Mountain sandstone, State Circle shale and Camp Hill sandstone. The Black Mountain sandstone occupied most of the central section and the core of the original hill.

Numerous faults, of various types and differing displacements, crossed the site. The faults generally contained fractured material but in some places were clean cut. There was an angular unconformity between the Camp Hill sandstone and the underlying Black Mountain sandstone. Efforts to preserve and expose sections of this older formation where it overlayed the more recent, were not practical because of the location and level, as it related to the building and landscape concept.

The strike and dip of the bedding, coupled with the fractured nature of the hard rock, caused considerable over break on detailed excavation. It was also necessary to remove large volumes of potentially unstable rock by battering on some high vertical excavation faces and to design support for others.

The ability to excavate by mechanical earthmoving equipment proved to be far less extensive than anticipated in the Black Mountain sandstone, with only two-three metres depth being achieved in spite of the extensive fracturing. Much of the excavation required large-scale drilling and blasting, which considerably altered the balance of the contract work.

The level of the building bench was raised 1.5 metres from the original design submission early in the excavation stage, to reduce the quantity of the more costly hard rock excavation and to provide a more even balance of cut to fill.

The hard rock blasting required close control because of the closeness of residential and Embassy areas. Oddly, the main effect from the blasting occurred because of particular atmospheric conditions with low cloud cover rather than by transfer through the ground. Charges and firing took account of these conditions as they became apparent.

An extensive public awareness exercise was undertaken and properties within a substantial radius of the hill were surveyed and photographed prior to and following blasting. This data was used as a basis for compensation claims. There were a number of claims which, except for the isolated extreme, were settled quickly and satisfactorily.

On the positive side, the hard but fractured Black Mountain sandstone was suitable for crushing and reuse as open granular backfill between the structure and the excavation. This resulted in a substantial saving as it had been expected that commercially available porous backfill quarried elsewhere would have to be brought to the site for this purpose.

The excavated material was mainly redistributed around the site. What material was not used on site was used to lift industrial land above the Jerrabomberra floodplain in the Fyshwick area and for the approaches to the Dairy Flat and Canberra Avenue bridges.

Structure

With reinforced concrete the main element in the building structure, a substantial amount of effort was applied to improving the concrete practices in Canberra. Detailed specialist reports identified serious shortfalls and for the design to be effectively implemented the appropriate concrete technology had to be followed from design through to construction, and in a consistent manner.

In the construction phase particular attention was directed towards:

- upgrading the ready mixed industry to code and specification requirements
- careful selection and strict control of aggregate source, cleanliness and handling
- specification of cement type and chemical composition and use of nominated air entraining agents to achieve a targeted entrain air content of 4.5 per cent.
- specification of extensive trial mix procedures, including pumping trials using nominated large capacity pumping equipment and detailed submission of production procedures at all stages of manufacture, delivery and placement
- nomination of responsible technical representatives and

attendance at fortnightly co-ordination meetings chaired by the Structural Consultant, with approved concrete technology specialists representing the supply consortium

- production at all times being rigorously restricted to approved computer and test-evaluated mix design. Control of water content with consequences upon workability, ease of pumping and shrinkage was a top priority. Strict control and union supported penalty conditions were applied to all delivery drivers, in respect of delivered water content
- sound placement, effective curing and protective membranes. Thermal blankets were used to overcome severe frost or winter conditions and hot dry evaporative summer conditions.
- education, advice to and quality control of the concrete placement contractors.

The office precast cladding, produced offsite and interstate, required low slump concrete with accurately controlled water/cement ratio and air entrainment. Galvanised reinforcement was used to enhance durability.

The Structural Consultant's engagement included total quality assurance responsibilities. His team was supplemented with a fulltime experienced concrete technologist who had continuous access to all offsite production and testing facilities.

Water stops were used at major joints in the roof slab to minimise free water penetration during the construction phase before the permanent roof, tanking and membrane was placed.

Apart from the tight time frame and the special attention given to the reinforced concrete components to raise performance and ensure required tolerances and finish, construction work was quite conventional.

Services

The low-rise spread nature of the building provided its own challenges in the service reticulation. Experience had shown that dedicated, easily accessible service tunnels were necessary to ensure efficient installation, operation and maintenance of services, as well as to readily accommodate future upgrading, augmentation and change in technology.

The nature of the building dictated that the goods access, waste disposal and basic internal transportation also occur at basement level. Therefore this required a system of interconnecting movement tunnels and corridors.

While the Construction Manager vigorously sought separate dedicated service tunnels, based upon experience at Westmead Hospital and Geelong Animal Health Laboratory, the Service Design Agent, Architect and Cost Planner felt that both the service reticulation and internal basement access requirements should be combined for the most economic solution. This was achievable as the large basement height allowed substantial ceiling space for the corridor service runs. Only minor lengths of dedicated service tunnels seemed to have been needed.

The space available for services in the access corridors at first appeared generous. The decision, however, required a high level of co-ordination for services installation. It necessitated working in confined spaces at ceiling level, requiring tight programming of access to work areas, which resulted in severe conflict at cross-connections in interconnecting corridors and reduced flexibility for future change or augmentation.

As work progressed, inevitably the decision to combine services into the same corridors was questioned. In retrospect a more extensive use of dedicated service tunnels, particularly in the areas of concentrated service, would have been prudent.

Crawl space was provided beneath the building where there were no basements and where future service adjustments or upgrading with new technology was likely.

Packaging, tendering, installation and supervision of services basically followed the zoning used in the design, programming, costing and control of the project. This zoning provided appropriate sized packages of work while allowing flexibility in the grouping of zones containing similar work for tendering purposes. Of necessity, there were also a number of services, stretching across large areas of the project, which in themselves were complete entities requiring treatment on a global basis.

The four basic building services, HVAC (heating, ventilation and air conditioning), power/lighting, hydraulics and fire protection fitted well into the zoning system. The global packaging was used with HV ring mains, document movement systems, waste disposal, communication and audio visual systems, which threaded throughout the kilometres of corridors and required close co-ordination with the basic building services in the limited space available.

Tender documents were prepared by the Construction Manager, based on the formally approved designs and using conditions of contract consistent with Commonwealth Government and PHCA policy. Standardisation of documents was essential, particularly for co-ordination of works with other contractors, for industrial matters and for the site conditions and facilities. The documentation was reviewed for gaps, overlaps, special conditions, form of contract etc before being approved by PHCA for tendering.

Tenders, following assessment by the Construction Manager and Design Agent, were recommended to PHCA for award of contract. The user was involved in the Authority's review processes on the more important equipment items, to make sure that they met operational and maintenance requirements.

The contract documents were specific in their requirement for services co-ordination, provision of shop drawings, contractors' responsibility in the joint drafting of co-ordinated service drawings, commissioning and handover of works and the provision of 'as constructed' drawings. The HVAC contractor took the lead in the development of the combined building service drawings which were co-ordinated over light tables.

The extent and complexity of the services co-ordination was foreseen at the start of the project and the feasibility of using computer-aided design (CAD) was considered. The Architect had initially favoured the use of CAD for the building design, finishing and fitout but retreated from it because of the cost of equipment, the learning time for staff and the reluctance of the user to accept the documentation in this form. Consideration was also given to using a commercial firm to provide a computer-aided services co-ordination drafting service. A number of contractors were keen to proceed this way but with commercial software for the HVAC (the lead service) unavailable by the cut-off dates and with the expressed wishes of the user for conventionally drafted records, PHCA was forced to proceed using light table co-ordination techniques.

This manual co-ordination, although a lengthy and tedious task, was a well worthwhile effort as service clashes experienced in the field were minimised and where they did occur were readily overcome.

By completion of the work both computer programmes and technology were becoming available in a form which would have eliminated the majority of manual co-ordi-

nation and possibly have overcome the many conflicts in the search for scarce services space.

Commissioning and handover of the complex involved considerations not normally encountered in the floor-by-floor occupation of conventional high rise office development.

For Parliament to move from the Provisional House required that all services and support facilities move to the new building at the same time. To achieve this the transfer of staff and backup facilities was arranged during the Winter Parliamentary Recess, so that the complex was up and running for the August 1988 Budget Session.

Much had to be done to ensure the move took place with the building providing an acceptable environment. Major equipment had to be run in, commissioned, adjusted and handed over before the movement date.

The PHCA Act made no provision for the running in, operation and maintenance of the facilities—handover of the individual components was required at practical completion of the contracts. To overcome this omission, arrangements were made at the start of the project for the user to build up an establishment consistent with the programmed progressive handover of the works. The indicative programme for this activity was provided to the user in 1983.

The intention was to have skilled people available to work with the contractors on all major plant items during final installation, testing and commissioning so that they would be completely familiar with equipment and have it properly functioning by the time of occupation.

Major service contracts included the pricing of a separate schedule covering an operation and maintenance service to be provided by the contractor. This schedule was available to be taken up by the user/owner under separate contracts if required.

While the early indicative handover programmes were somewhat optimistic, for a variety of reasons, the user seemed to have underestimated the size and complexity of the operation and maintenance task. This resulted in a slower than necessary buildup of establishment staffing, resulting in many of the contractors being required to operate equipment well past their contract completion dates.

Services, plant rooms, parking areas etc were progressively handed over from 1986, while the building structure handover started in January 1988.

QUALITY ASSURANCE

Quality and high standard of finish was a major feature of the design. While established technology and materials were required, these were used to fine tolerances and intricate detail to achieve a consistently high standard on a structure required to last two hundred years.

Achievement of quality and standard of workmanship was the responsibility of each contractor. Although the Superintendent was responsible for ensuring that the contractor met his obligations, quantum and time were an integral part of the contract and even with the best will by all, the ever-present conflict between time, cost and quality continued to emerge.

The rate of progress required close attention by the Superintendent and frequently inhibited standing back and spending time analysing problem areas. Contractors also tended to fall back on what they regarded as an industry or 'Canberra practice' which was not what was specified or required by the contract and which did not, in many cases, meet codes or Australian Standards.

With construction occurring concurrently across a number of zones and with considerable off-site work spread through Australia, the maintenance of a consistent overall approach to testing, quality, and quick resolution of problems was imperative. Advance warning of problem areas and the dissemination of solutions to all affected zones of the work was essential, especially where a number of contractors were undertaking similar or inter-related work.

To meet the pressing and foreseen needs in a positive way, the establishment of a Quality Assurance Group (QAG) was examined in late 1982. Although construction was then still in the initial stages, the group was established mid-1983, to be operational before the more detailed works were committed.

As there were no Australian experience, codes or standards covering such activities, procedures were adapted from the Canadian Standards Association Special Publication Z299.0—1979. Procedures did, however, exclude design aspects because of the special competition base and Parliamentary approval of the design.

The Architect and Design Agents provided advice and service to the QAG, whose role include ensuring prompt technical resolution of problems as well as the overview and analysis of control, testing and inspection.

The group proved to be extremely effective and resulted in a consistently high quality product throughout. Perhaps more importantly, the project resulted in a better trained construction workforce and improved standards of workmanship across a whole range of building activities in Canberra and perhaps Australia.

PROJECT COST

The cost of the new Parliament House project was, in round figures, 1.1 billion dollars.

Costs for major Government projects had received critical exposure over many years, largely because of the methods used in authorisation and budgeting. These methods were quite different from those used for private developments or general overseas practice.

Public sector finance departments require that all estimates and predictions be in "present day costs" and that no allowances be made for escalation, rise and fall or contingencies, these being covered by adjustments to authorisation and budgets as they occur.

While this presents no problems in comprehension for relatively short-term projects, the media and public's perception is severely stretched on long-duration projects, particularly when a budget is established prior to concept and additions and changes are made during the course of the work. The new Parliament House project was no exception.

The initial estimate of $151 million was developed in 1977 before the user requirements were fully established and without a design concept. This figure was for building only. It did not include furniture or any of the detailed equipment normally installed by the owner, user or Commonwealth services departments. The competition to select an Architect, launched in 1978, was based on that figure.

During the competition, an indicative costing of the brief was independently undertaken by a leading firm of quantity surveyors. This assumed a hypothetical arrangement for a national building to high standard office quality, applying realistic efficiency factors of usable to gross floor areas consistent with circulation movements. An order of cost slightly above $200 million emerged. This indicative cost-

ing could not be given exposure, even within the project team, as the competition had not closed.

The competition entries all, predictably, ranged around the $151 million mark. The winning design (number 177) was for a gross budget of $156,417,000.

Once the competition winner was announced, the full documentation was made available to the project team which undertook a preliminary analysis of the cost and assessed it between $230 million and $240 million. The project Cost Planner believed that the figure should be higher, while the Architect's Quantity Surveyor maintained that a figure around $185 million was appropriate.

When the Architect arrived in Australia, intense detailed discussions were held over a concentrated period to determine the precise design intent for the various components of the building, the materials used and the quality and finishes to be applied and to place a realistic costing on the project.

The figure reached included allowances for contingencies, industrial action, and miscellaneous adjustments inevitable in the detailing of the design. These allowances were removed from the costing as directed and a project budget of $220 million emerged. This figure was the basis of the Parliamentary Approval for the project and became the Approved Budget.

The costing was based at "May 1978" prices for comparison with the competition budget and all subsequent reporting on the Approved Building Budget was to this base.

Costs were controlled to a comprehensive cost plan, detailing the various items and trades for each of the 25 zones of the building. This control covered all preliminaries and establishment, as well as the building design and included allowances for variations to awarded contracts. Control of contracts was in accordance with the conditions of contract and was exercised by the Superintendent, with the assistance of the Cost Planner and later from the Cost Control Services.

The main impact on cost increases was escalation with

Date	Building budget (May '78) $M	NBI (June '81) $M	Approved additions (accumulated) $M	Escalation (accumulated) $M	Industrial insolvencies & Cumulative exchange rate $M	Project Budget $M
			—			
May 1978	220	—	—	—	—	220
Jun 1980	220	—	8[a]	55	—	275
Jun 1981	220	82	8	82	—	392
Sep 1981	220	82	9[b]	98	—	408
Dec 1981	220	82	9	125	—	436
Mar 1982	220	82	9	152	—	463
Sep 1982	220	82	9	201	—	512
Mar 1983	220	82	13[c]	215	—	526
Sep 1983	220	82	13	233	—	548
Feb 1984	220	82	54[d]	273	—	588
Aug 1984	220	82	54	288	—	644
Feb 1985	220	82	203[e]	328	—	684
Aug 1985	220	82	191[f]	360	29	894
Feb 1986	220	82	191	398	37	928
Aug 1986	220	82	196[g]	438	51	982
May 1987	220	82	203[h]	463	66	1027
Aug 1987	220	82	204[i]	471	72	1048
Nov 1987	220	82	205[j]	476	74	1056
Feb 1988	220	82	205	481	76	1064
May 1988	220	82	205	483	79	1069
Aug 1988	220	82	205	485	81	1074

(a) Additional user requirements to provide, for example, dining facilities and relocate security areas.
(b) Additional user requirements for southern security.
(c) Additional funds to enlarge the capacity of Eastern Car Park and place it underground.
(d) Increase in funds to add extensions to both House of Representatives and Senate wings following increases in the number of Members/Senators.
(e) Increase following overall budget review based on a report by an Interdepartmental Committee, comprising $62M of additional requirements and $87M which would normally come from contingency allowances but which were excluded from the original budgets.
(f) Net reductions of $12 million following assessment of budget and Government budget decision to reduce costs.
(g) Additional $5 million for landscaping.
(h) Increase of $7 million associated with the costs of reinstating some works deleted or deferred in 1986.
(i) Increase of $1 million for two additional Ministers' suites and further reinstatement of deleted works.
(j) Increase of $1 million for third additional Minister's suite and cost of decision not to continue using rainforest timber.

Fig. 13.13: Tabulated movements in approved budget.

the Building Construction Cost Index escalating from 100 at May 1978 to 354.60 at completion. Increases to the approved budget for uncommitted work were approved in line with increases in the index. Escalation to committed works was in accordance with the Rise and Fall clauses of the particular contracts.

Other major factors influencing cost was additional work, namely:

1. Additions approved by the Government, such as increased number of members' suites, enlarging and placing carparking underground, etc.
2. Non-building items, such as furniture, artworks, security devices, telephones, 11 kV supply and the like. When introduced in 1981, the estimated cost of these non-building items was $82 million.

Industrial action, insolvencies and exchange rate fluctuations also considerably affected the costs.

The detailed break-up of these various costs is shown in the tabulation (Fig. 13.13) and graph (Fig. 13.14).

OCCUPATION OF BUILDING

The building and fitout was progressively handed over to the Joint House Department from January 1988.

Formal opening of the Building by HRH Queen Elizabeth II occurred on the 9 May 1988. Occupation and transfer of facilities from the Provisional Parliament House occurred over the Winter Parliamentary Recess to be available for the first session of Parliament in the Budget Session of August 1988.

CONSULTANTS

Major consultants who worked on the project were: *Architects*—Mitchell/Giurgola & Thorp Architects; *Interior Design*—Mitchell/Giurgola & Thorp Architects; *Structural Engineer*—Irwin Johnston & Partners; *Associated Consulting Engineers for the Parliament House (ACEPH)*—Joseph R. Loring and Associates, Norman Disney & Young, W.E. Bassett & Partners Pty Ltd, Leadingham Hensby Oxley & Partners; *Landscape Architect*—Peter G. Rolland & Associates; *Quantity Surveyor*—Donald Cant, Watts, Hawes & Lee Pty Ltd; *Civil Engineers*— Maunsell & Partners; *Construction Manager*—Concrete Holland Joint Venture; *Project Planner*—McLachlan Group Pty Ltd; *Cost Planner*—Rawlinson Roberts & Associates; *Cost Advice*—McLachlan Group Pty Ltd, Rawlinson Roberts & Associates, Cost and Data Support Services Pty Ltd; *Sound and Vision*—Australian Broadcasting Corporation; *Security*—Department of Housing and Construction/Department of Administrative Services; *Window & facade weather testing*—CSIRO (Csironet); *Acoustics and Vibration Engineers*—Louis A. Challis and Associates Pty Ltd; *Stonework*—Australian Mineral Development Laboratories (AMDEL); *Earthworks*—Scott & Furphy Engineers Pty Ltd; *Refreshment Services*—Commercial Kitchen Consultants Pty Ltd; *Insurance*—Sedgwick Ltd; *Lighting*—George Sexton Associates, GEC/Philips Opera House Lighting Co Pty Ltd; *Architectural Hardware*—Keeler Hardware Pty Ltd; *Life Safety*— Rolf Jensen & Associates Inc; *Water Feature*—Robert Woodward, Peter Rolland & Associates; *Roofing*—ARMM Consultants Inc, CSIRO, *Flag Hoisting*—Alan Payne & Partners Pty Ltd; *Flagmast Access*—Johns Perry Lifts; *Geotechnical*—Coffey & Partners Pty Ltd; *Concrete Technology*—Bemac Laboratories Pty Ltd; *Wind*—Professor W. Melbourne; *Steel Pre-order*—Johns Perry Ltd; *Welding Inspection*—Metlab Mapel Pty Ltd; *Flagmast Elastic Stability*—Professor P.

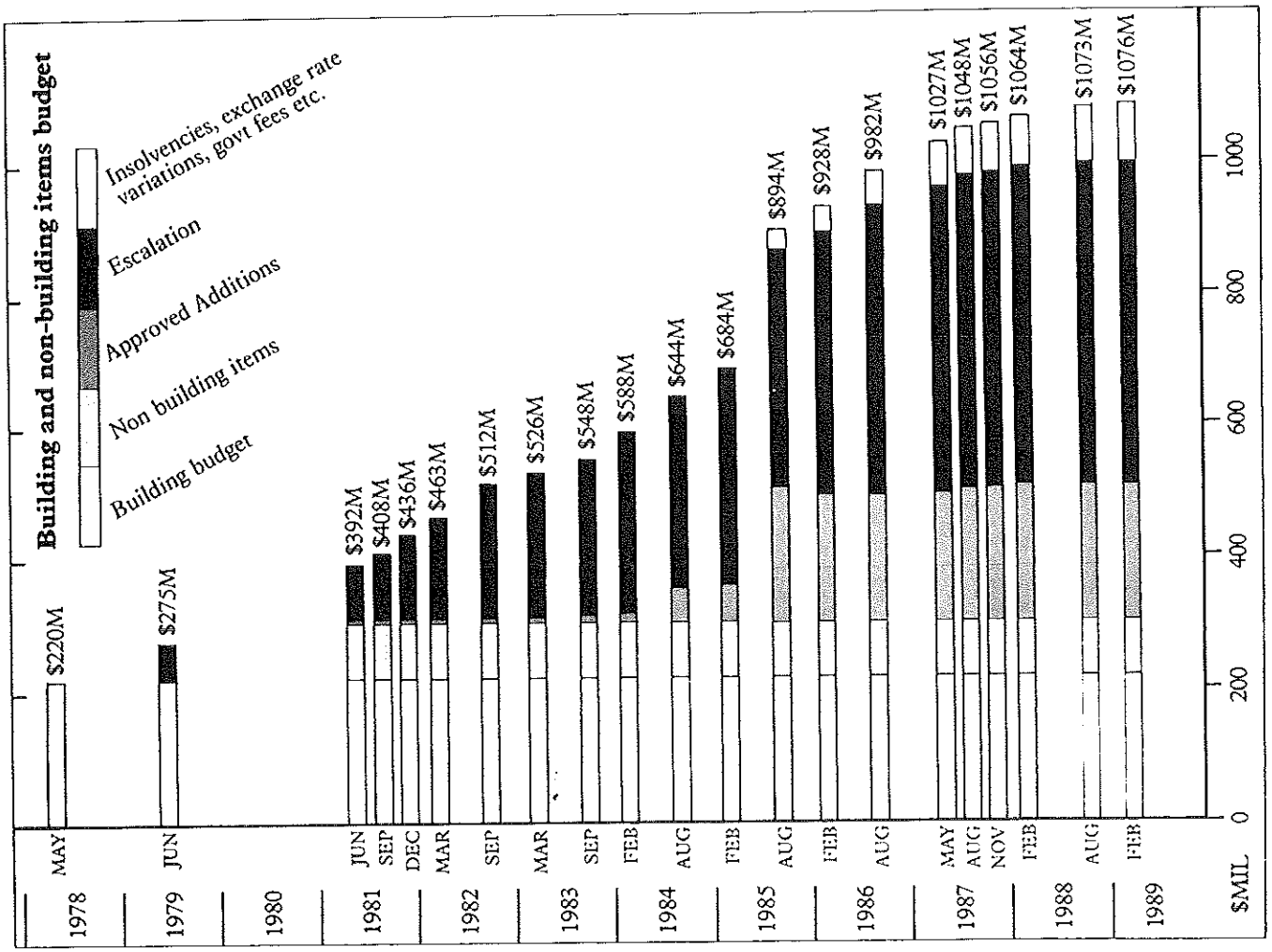


Fig. 13.14: Project cost — graph showing movements in approved budget.

Fig. 13.15: HRH Queen Elizabeth II and the Prime Minister, Mr. R.J. Hawke, enter the foyer of the new Parliament House after its formal opening on 9 May 1988.

Grundy, Professor L.C. Schmidt; *Irrigation*—Irrigation Design Consultants; *Operations & Maintenance Manuals*—Australian Industrial Publications Pty Ltd; *Contractual Consultants*—Bill Guy & Partners, Construction Contract Services; *Solicitors*—Australian Government Solicitor, Morris Fletcher & Cross.

ACKNOWLEDGEMENTS

The authors express their appreciation to the Parliament House Construction Authority, for the use of files, reference materials, reports and diagrams, and to the Library of the National Capital Planning Authority.

Special thanks also go to Mr John Fowler, Director of Irwin Johnston & Partners Engineers Pty Ltd for review and technical comment on the text, and to the partners of Mitchell/Giurgola & Thorp Architects for their comments and the use of diagrams from their competition winning documentation.

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ATTACHMENT F

Chapter Fourteen

THE ROADS AND BRIDGES LEADING TO THE NEW PARLIAMENT HOUSE

Keith Downey Dip CE, Dip Theol, FIE Aust
John Connal Dip CE, BE, MEngSci, MIE Aust

Keith Downey has spent 30 years engaged in the design and construction of a wide range of civil engineering projects in Victoria, Tasmania and Papua New Guinea. For the past 15 years he has worked for the National Capital Development Commission in various positions involved with the planning and design of major engineering facilities in the ACT. He was the Commission's Design Manager for the Parliament House access roads project. He is now Director of Capital Works and Services with the National Capital Planning Authority.

John Connal is a graduate of Melbourne University and has spent 16 years in the design of civil engineering works; the past six of these having been in Canberra. He is an Associate of the consulting engineers, Maunsell and Partners, for which he has been involved on major development projects in Canberra, having moved to the National Capital originally to work on the Parliament House access roads project.

THE design and construction of the roads and bridges to the new Parliament House provided a rare opportunity where the blended skills of a wide range of professions was needed, to produce an integral, harmonious and appealing solution.

The success of the blending process is evident by the local and national recognition the work received. It was awarded Engineering Excellence awards, firstly for the bridge elements and later for the project as a whole, from the Canberra Division of the Institution of Engineers, Australia, as well as awards from the Association of Consulting Engineers Australia and from the Concrete Institute of Australia.

Clearly, in such a significant project the influence of key people is visible in the finished product. Primarily, in this instance, it is the touch of Aldo Giurgola, of the project Architects for the new House, Mitchell/Giurgola and Thorp (MGT). As far as the roads and bridges are concerned, the other major influences came from the late Richard Gray, formerly of Holford & Partners (United Kingdom), who was design adviser for the project to the then National Capital Development Commission (NCDC) as well as from architectural staff of the Commission.

The NCDC was the client for this work as it was responsible for all works associated with the House outside the 320 metre radius of the actual Capital Hill site.

EVOLUTION OF THE CONCEPT

The job of providing access to the new Parliament House, whatever the design of the House, was always going to be challenging. The Hill was at a node in Canberra's transport system, with the surrounding roads serving both a wider metropolitan function as well as local access needs. The rotary interchange system of State and Capital Circles accommodated the peak traffic flows between Commonwealth and Adelaide Avenues, with more than 43,000 vehicles using the route daily in 1980.

MGT's winning design added yet a further dimension to the task.

The access solution not only had to contend with the strengths and weaknesses of the existing transport system, plus provide for the future traffic demand for that part of

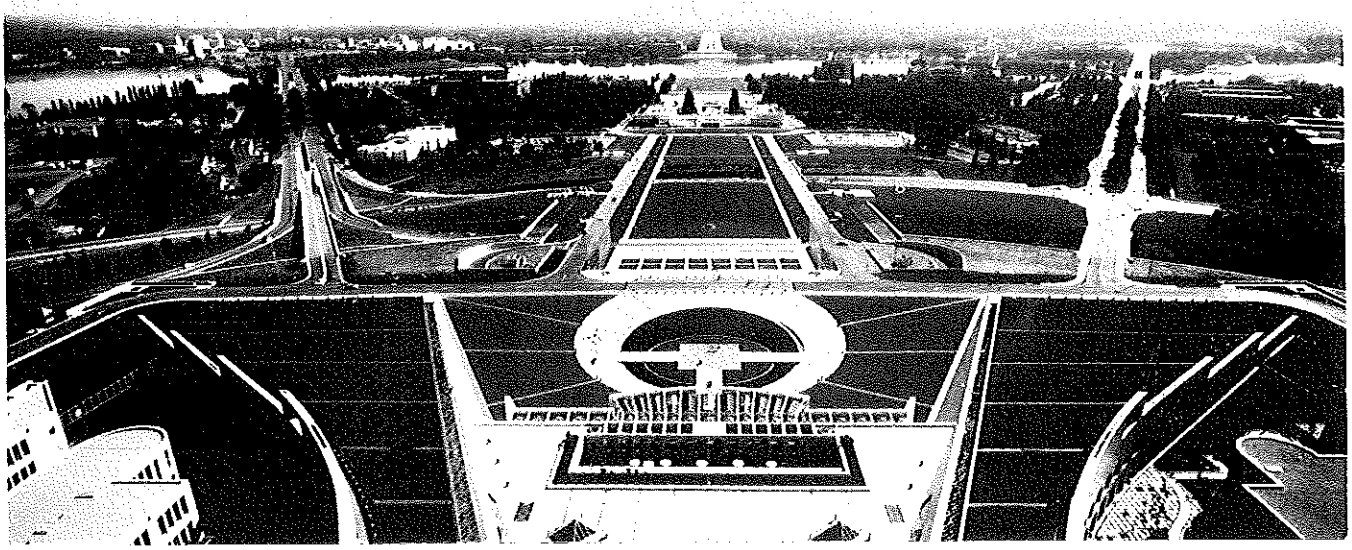


Fig. 14.1: The access roads converge on the northern entry to Parliament House (view from the top of the flagmast). Source: NCDC.

the transport network, but also had to provide safe and convenient access to the new House.

With up to 3,000 people working in the House, plus official visitors (including Heads of State) and more than one million tourists annually, the roads to the House had to cater for a diversity of visitors and modes of transport: private vehicles, buses, service delivery vehicles, vehicles in ceremonial processions, people on foot and on bicycles.

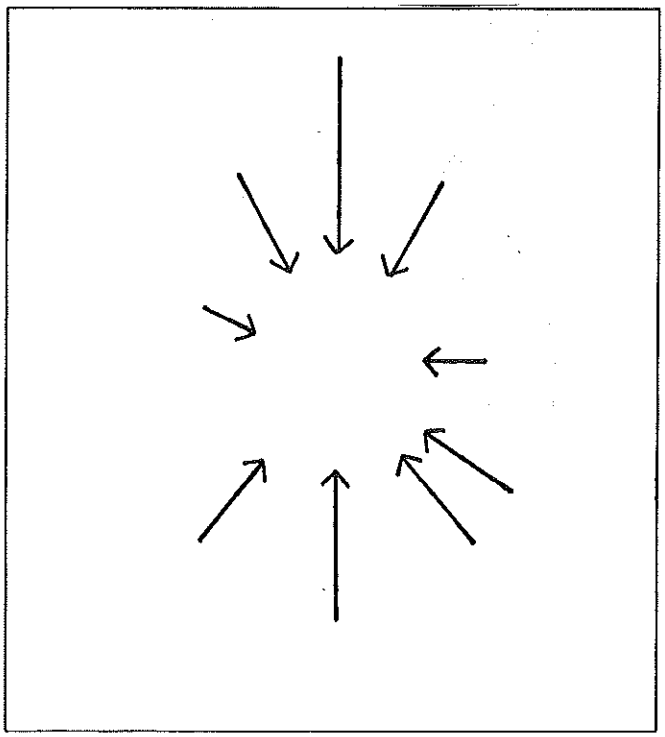
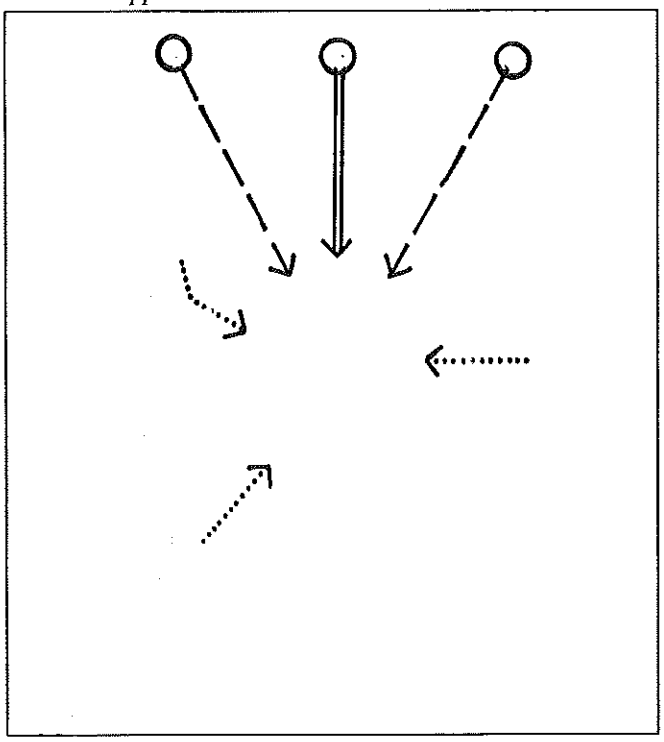


Fig. 14.2: Parliament House Competition Document — access opportunities.



Legend:
- ⟸ Ceremonial and Tourist
- ⟸ - - - Business and Tourists
- ⟸ ····· Employee, Business and Service
- ○— Decision Point

Fig. 14.3: Access proposal embodied in the winning MGT design.

The original competition design brief for the new House contained possible access options including the radial avenues and the symbolic access from the Land Axis (the House is at the southern end of Griffin's land axis from Mt Ainslie, the Australian War Memorial and Anzac Parade). MGT's design chose to provide functional access from the Adelaide, Commonwealth and Kings Avenues, with service access from Brisbane Avenue. Ceremonial access was directly up the Land Axis. This meant, of course, that with no access from either Capital or State Circles a visitor would have to choose a route to the House some distance from the Hill.

There were concerns that this lack of clarity would be unacceptable. An early task for Maunsell & Partners, who had been selected by NCDC in 1980, as Civil Engineering Consultants for the roads and bridges, was to provide a feasibility study for the proposed road design. The major elements of the MGT design which had to be considered in the study were:

- a large entrance forecourt on the northern side of the new House
- an internal, circulatory access system (now known as Parliament Drive)
- two new roads extending from the medians of Commonwealth and Kings Avenues
- a road link from the median of Adelaide Avenue.

These aspects of the design raised some fundamental issues. Problems of level differences, continuity of the Land Axis and traffic safety all required sensitive consideration to meet the new requirements of the design, along with the existing demands of the traffic system.

Some innovative, and even some outlandish solutions were contemplated, such as:

- lowering the House to reduce the approach grades to it
- filling in State Circle to provide at-grade entrance to Capital Hill from the Land Axis
- physically shifting the existing bridges which took Commonwealth Avenue over State Circle, to provide structures at the rear of the House
- rearranging roads within the Parliamentary Triangle to improve the central access to the site, at the expense of restricting access from the Avenues.

While an over-riding factor was always that of budget, it is hardly surprising that the impact of some of these proposals stirred lengthy debate among the various disciplines involved.

Probably the most difficult compromise to reach involved the question of levels. The topography of the site and all the requirements of the House design were incompatible with simple and unobtrusive connections from the two main access roads — Commonwealth Avenue and Kings Avenue.

The construction of a link to the new House, along an extension of the Commonwealth Avenue median, with a maximum grade of 8 per cent to Parliament Drive from a point south of State Circle, dictated a maximum achievable level of RL583m at Parliament Drive. Maintaining symmetry across the Forecourt of the House, as was implicit in the design for the House, meant that the Kings Avenue extension would have to be at the same level. That would require Kings Avenue being lowered by 3 metres at its intersection with State Circle. This option was clearly unacceptable, as it would require a gross distortion of the Capital Circle profile to meet clearance requirements, and would also require major earthworks, with significant

reconstruction costs, on State Circle.

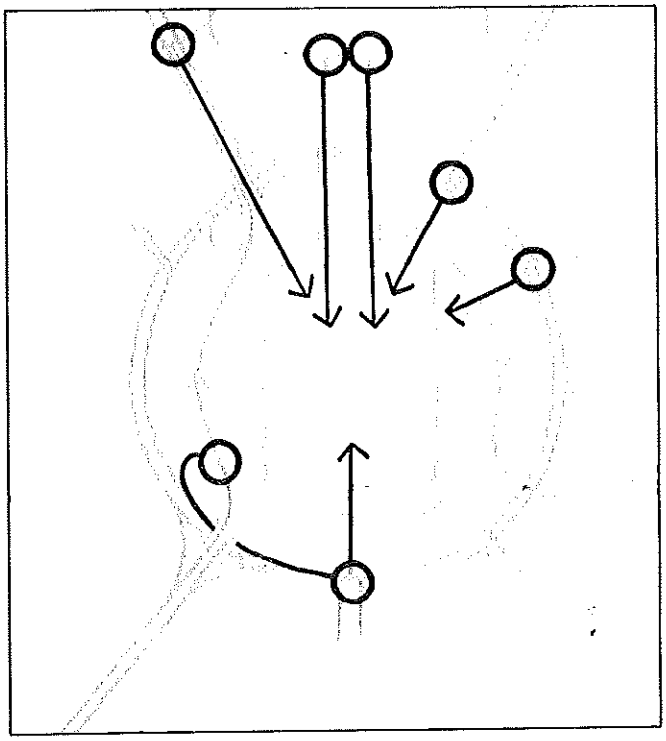
The solution adopted has an 8 percent grade from north of the existing bridges over State Circle which has the effect of vertically separating the extension above the level of the existing structures. While this created a number of complexities and the need for a new bridge in the median of Commonwealth Avenue over State Circle, it allowed the development of the appropriate elevation and entry arrangement onto Capital Hill.

Maunsell & Partners' feasibility study showed quite clearly that MGT's original proposal to provide a southern link from Adelaide Avenue would be unworkable because of

a. the anticipated amount of through-traffic on Parliament Drive, caused by the relatively direct nature of the link between Adelaide Avenue and Commonwealth Avenue
b. the location of the median offtake on a crest and the need for traffic to cross an express bus lane.

Studies indicated two-way traffic volumes on Parliament Drive would exceed 1,000 vehicles per hour even when the average speed was reduced to 25 km/h, to reflect the likely interference to through traffic of vehicles turning into carparks around Parliament House. This number of vehicles was considered to be unacceptable for Parliament Drive. This led to the alternative southern access being provided at Melbourne Avenue via a bridge over Capital Circle which, for clearance reasons, required Capital Circle to be lowered about 1.5 metres.

The key to good accessibility to the House was Kings Avenue. Here it was possible to provide an at-grade intersection with State Circle, the prime distributor road to Capital Hill. Direct access is made to Parliament House from both directions on State Circle and from Kings Avenue, the route being grade separated at Capital Circle, with a bridge structure, and involving some regrading and full signalisation of the Kings Avenue-State Circle intersection.



Legend: ○— Decision Point

Fig. 14.4: The compromise solution.

MGT's original design proposed complex three-way intersections at the junctions of the Avenue extensions with Parliament Drive. When it became clear it would be extremely difficult to provide for comfortable and safe traffic flows, these were modified to simple T-junctions. They allow better resolution of levels on the Forecourt and easier access to the carpark underneath.

By early 1981 a compromise layout had been reached (Figure 14.4). It embodied:

- preservation of the integrity of the winning design
- providing a safer, more convenient southern access at Melbourne Avenue.
- satisfying the need for a high level of accessibility with an at-grade intersection between State Circle and Kings Avenue
- segregating the high speed inter-town traffic on Capital Circle/Adelaide Avenue from the traffic accessing Capital Hill
- maximising the future capacity of the total traffic system to deal with general increases in urban traffic
- preserving the geological feature in the State Circle cutting, which had been retained as a significant feature in earlier engineering works.

All this was achievable at an acceptable cost, estimated at $30 million (1988 prices).

THE DESIGN PROCESS

Structures

The structures are the most dominant visual aspect of the access solution. The major consideration during their design was that they have all the necessary qualities of functional road structures, as well as being compatible with their setting.

The fundamental aesthetic quality desired of the bridges was that they could be viewed as bridges in the landscape of a country estate, inspired by the tradition of fine bridges built in Australia in the 19th century and suggesting the antithesis of high speed, highway structures. They all had to have high aesthetic quality for both the upper roadway and the lower roadway, being both major traffic routes and used occasionally for ceremonial functions. Additionally, they should have a "family" relationship to each other and to the existing bridges in the area, through consistency of basic shapes and details.

To achieve the "family" solution of bridges, many variables had to be melded into a consistent theme. They included variable road widths, different footpath widths, different pier heights, consistency of new details and compatibility of the new details with those of the existing bridges in the precinct.

It was no easy task and required input from a range of architectural consultants, from NCDC and from those advising Maunsell & Partners and the Parliament House Construction Authority (PHCA).

Landscape

From Griffin onwards the Central Area of Canberra has been developed on the basis of strong landscape concepts. Hence, the design concepts for both the new Parliament House and the adjacent Parliamentary Triangle rely heavily on major landscape elements for their integrity.

MGT's design for the House relied heavily on using tree planting to frame some views, while leaving others open. Trees also would be important as windbreaks.

The Access Roads project, therefore, had to provide a landscape solution that integrated the design concepts on the Hill with those of the surrounding areas. The solution is based on native species planted both formally and informally.

Considerable engineering works were required to establish the ideal planting conditions, drainage and irrigation systems.

The complexity of these issues, as well as judging future growth of the trees resulted in the use of computer graphics techniques to understand the interactions. The computer-based work included generation of perspectives and simulation of movement along the major vehicle routes. These were varied to understand the situation in 1988, as well as next century when the trees will have reached maturity.

Traffic During Construction

Capital and State Circles are focal points for the distribution of central area traffic to the south. The free flowing Capital Circle accommodated the major traffic movements between Commonwealth and Adelaide Avenues, especially during peak periods. Therefore, considerable emphasis had to be placed on packaging and timing of works, so construction could occur, as far as possible, under traffic. Traffic-related considerations in phasing the work included:

- the total period for construction was to be about four years, from early 1983
- the need to construct the work in packages, to suit various financial and programming constraints
- the advantages to be gained from closing sections of the road network during construction of the bridge structures
- the need to ensure that convenient alternative routes were available when roads were closed.

There had to be access for up to 2,200 workers on the Capital Hill construction site. Additionally, as the work areas on the site changed, access locations had to be modified to match, as near as possible, the changes.

Numerous options were considered in each stage, taking account of the complex inter-relationships between the separate contracts, the physical requirements of each stage of the work and the changing access requirements. Sixty-two traffic staging drawings were produced during this task. The movement of traffic through the site was never seriously impeded during the construction process.

The Solution

The elements which comprised the total access solution to the new House are many and varied. However, all these elements were designed to be complementary, in both principle and detail, to the architecture and landscape of the House, while providing functional access to the House and to integrate the House design into the surrounding precincts.

The principal elements of the access solution were:

- roadworks (including cycle paths and footpaths) at Adelaide Avenue, the Adelaide Avenue-State Circle interchange, Melbourne Avenue, Canberra Avenue, Kings Avenue, Commonwealth Avenue, the Land Axis, State Circle, Capital Circle and in the Parliamentary Triangle
- bridges carrying Melbourne Avenue over Capital Circle and Kings Avenue over Capital Circle and twin bridges on the Land Axis over State Circle
- a tunnel carrying Capital Circle under the Land Axis roads
- a box section viaduct on the Commonwealth Avenue extension, linking the new median bridge over State Circle with the bridge onto Capital Hill
- retaining walls associated with the bridges and tunnel
- a pedestrian and cycle underpass on State Circle near Flynn Drive
- bulk excavation of about 300,000 cubic metres on Camp Hill and filling of the sector of the Land Bridge between State and Capital Circles and the Avenue extensions
- new drainage and service lines to the Parliament House and diversions of existing services to facilitate construction

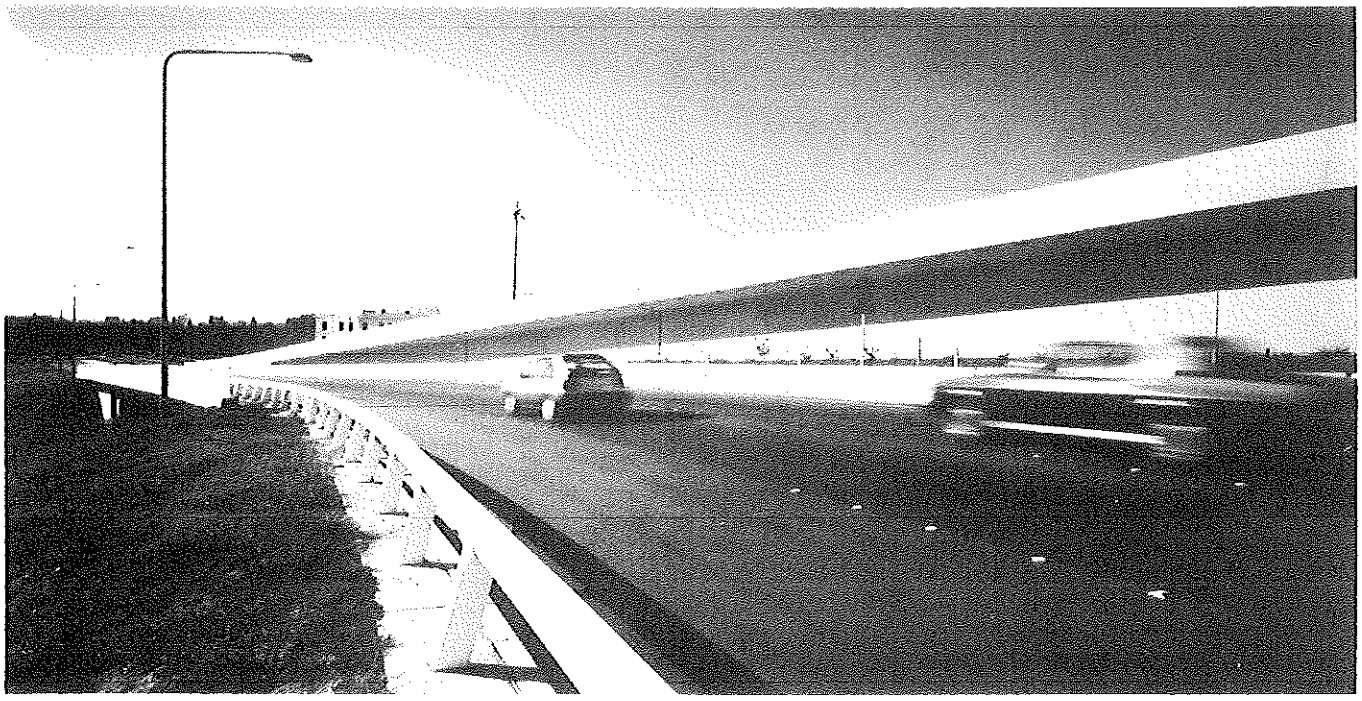


Fig. 14.5: Commonwealth Avenue extension from Capital Circle.

of the new roads, bridges and tunnel
- drainage augmentation works, including construction of two new retarding basins
- soft and hard landscaping
- protection of a geologically significant cutting on State Circle and construction of a viewing platform on the Land Axis.

Both the architectural and engineering aspirations for the structures were achieved by creating a construction environment compatible with the production of high quality work. Specification of the concrete work involved consultation with concrete manufacturers and with the PHCA and its other consultants. Prototypes were constructed for all major elements of the work, with trials of different types of surface finish to select a finish both economical and appropriate for the location. Formwork stripping times for all exposed concrete surfaces were carefully controlled to ensure good colour control.

While there were exacting requirements for workmanship, and access was difficult to much of the work, the design and construction proved to be economical. Construction techniques were generally conventional and careful planning allowed completion of the structures ahead of schedule.

PRINCIPAL ELEMENTS

Commonwealth Avenue Extension

The highly prominent extension of Commonwealth Avenue onto Capital Hill required the building of a new bridge between the two existing bridges. The new median bridge is raised above the levels of the existing bridges.

With three separate bridges merging in the middle of Commonwealth Avenue from two different vertical and horizontal alignments, the resolution of the converging lines required considerable analysis and thought. Physical models aided the design process, which was further complicated by the fact that the ramps from and to Capital Circle were at slightly differing levels. In the final design the integration of precast parapet units and insitu concrete faces, some with warping geometry, provided a solution that provides a safe driving environment and has smooth, clean lines which are pleasing to the eye.

The bridge over State Circle fills in between the existing bridges, providing the effect of a continuous short tunnel beneath the bridge. This tunnel effect was reduced by recessing the soffit of the new deck above the level of the existing deck soffits. The same bearing ribs as those on the existing bridges are used on the new bridge and up-lighting onto the soffit is used to enhance the lift of the new central soffit area. This emphasises the emergence of the new bridge and lightens the space below the structures.

Between the bridge over State Circle and the bridge onto Capital Hill, is a box viaduct which sits on fill and is fully supported along its length. The walls of the box section provide the visual impression of a road extension, giving a functional symmetry of approach to Capital Hill which parallels that at Kings Avenue.

The project frequently called for innovative solutions. Early in the design process, options for the abutments of the new State Circle bridge were investigated. With the new bridge higher than the existing structures, yet needing to maintain the same foundation levels at the abutments, it required large tall abutments. With a conventional design approach, these abutments would have had massive footings and wall sizes. Instead, the economical solution of using approach spans was adopted. With this method the space is spanned by approach spans of beam and slab construction. In order to maintain the visual continuity of the bridge structure, the approach spans were founded on the rear faces of the cast insitu section of the bridge over State Circle.

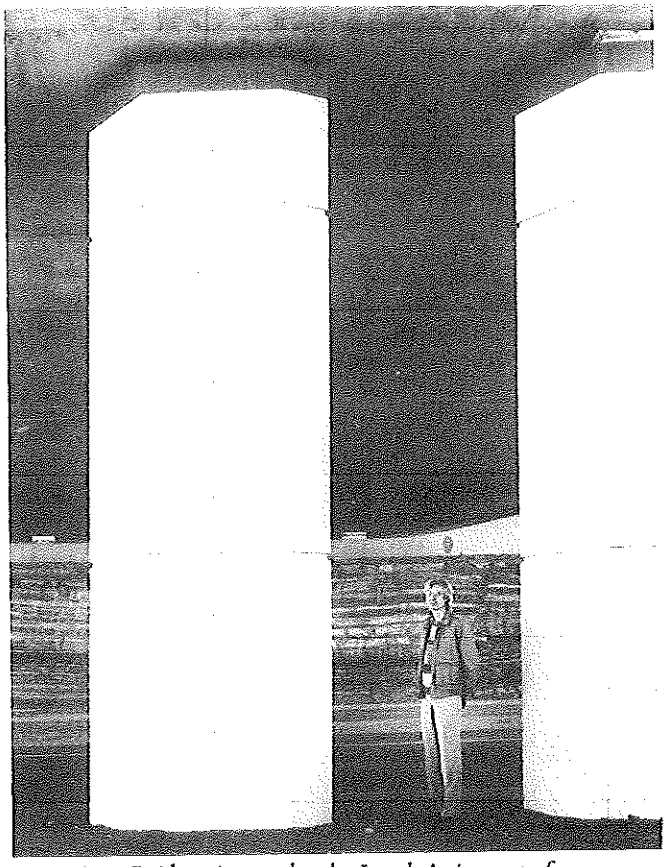


Fig. 14.6: Bridge piers under the Land Axis, part of a common theme for all bridges.

The end bridge on the Commonwealth Avenue extension is an asymmetrical structure. It has the appearance of being firmly established in the landscape on the north side, yet "leaping" across onto Capital Hill. The thin deck section where the bridge passes onto the Hill was achieved by counterweighting the bridge with a mass concrete weight hidden behind the side walls of the abutment. This counterweight reduces the mid-span bending movements to achieve the slender, asymmetrical structure. The support of the bridge at the northern abutment uses a bearing rib arrangement similar to the bridges over State Circle further north on the Avenue extension.

The Land Axis

The Land Axis links the new Parliament House to the Provisional House, with a formal approach of constant grade. A design requirement was that the Land Axis provide natural, uncomplicated vehicle access, plus a comfortable pedestrian access. The formality of the approach is achieved by providing a continuity of landscape between the two buildings with irrigated grass and native tree planting which emphasises the linear nature of the Land Axis.

The continuation of irrigated grass over State Circle is achieved by the unusual solution of providing planter boxes on the two bridges carrying the Land Axis roads over State Circle. Grading of the deck surface, waterproofing, drainage and soil were all chosen to encourage a quality grass surface with no apparent difference between the grass in

this artificial planting environment and that on the adjacent natural ground.

The bridges are shallow, prestressed girder structures with a banana-shaped underbelly which was specifically chosen to emphasise the slender nature of the bridges. They have a bold and simple fascia created by a precast panel which is angled to catch the light, and for frequent washing by rain.

The design of the bridges meets all NAASRA specified loadings and includes stresses due to temperature differentials through the depth of the deck. Additionally, as the bridges were used to carry construction vehicles during the excavation of Camp Hill, they were designed to support loaded scrapers. The scrapers were restricted to the central strip of the bridge to reduce asymmetrical loadings. A speed restriction was also imposed on construction vehicles to reduce load impacts.

The piers which support the deck comprise three columns of varying height at each location and between the bridges. Thoughtful design was required to ensure the bridges did not create a forest of columns. After architectural consultation, the result was a set of angular columns with carefully chosen horizontal joints relating the columns to each other. The angular cross section was chosen to reduce the visual mass of columns. The columns have been repeated on the Melbourne Avenue bridge in a two-column pier arrangement.

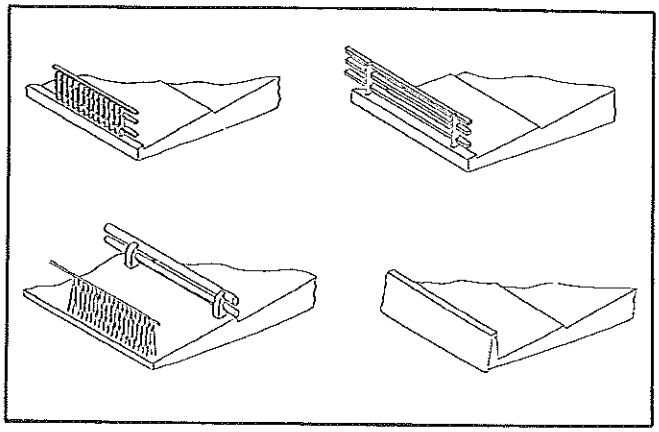


Fig. 14.7: Diagrams of parapet options considered. The adopted parapet is shown at the lower right.

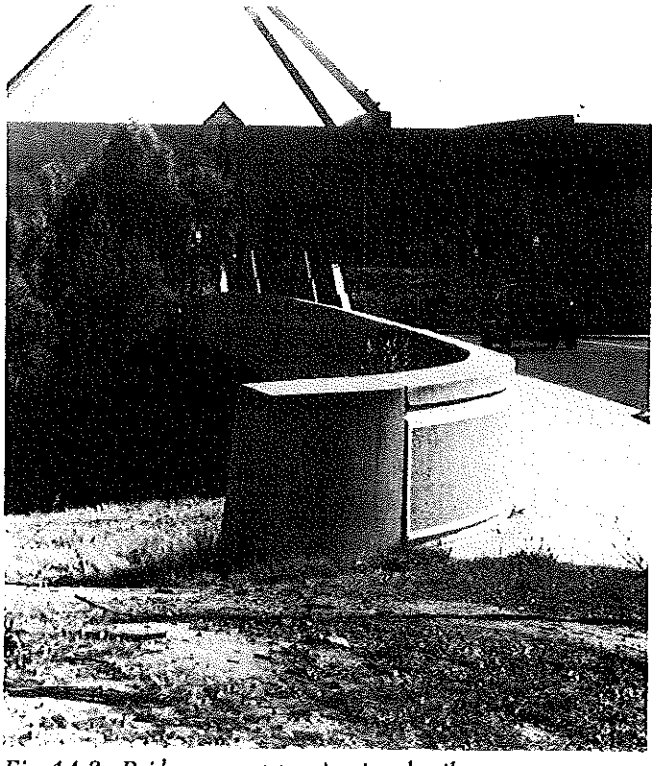


Fig. 14.8: Bridge parapet termination details.

Parapets

A great deal of attention was given to producing the most appropriate design for the bridge balustrades and their terminations. This was necessary because they would be visually the strongest and most easily identifiable "family" components of the bridges, both for users and as elements in the landscape. A wide range of crashrail, handrail and balustrade alternatives was considered.

Standard specifications require that all road overbridges be designed to prevent vehicles from penetrating the edges of the bridges and crashing onto the road below. On conventional highway structures this is achieved by making the bridge handrails strong enough to contain vehicles or by incorporating a vehicular barrier adjacent to the kerb. However, this project called for estate bridges (bridges in the landscape), for which conventional techniques were unsuitable. After much analysis of steel and concrete barrier options, an edge parapet treatment was adopted for both structural and aesthetic reasons. It consists of a solid concrete balustrade surmounted by clean, crisp, precast fascia units. The overall height of the concrete parapet is 1.1 metres and the outer faces are sloped outwards to enhance the ability of the concrete to maintain a uniform colour as it weathers and to minimise buildup of grime.

The strong, clean lines of the solid balustrades, in conjunction with the bridge structures, achieve the desired blending with the landscape and the House.

The termination of a bridge balustrade is as important as the balustrade itself. The estate bridge theme suggested that the parapets should have positive terminations in harmony with the landscape. Various options were examined, and led to the adoption of a detail commonly used on the stone-arch bridges of the last century. The ends of the parapets gently flare away from the roadway and terminate with concrete bollards.

A similar parapet was used on the tops of the Capital Circle tunnel portals, to provide yet another link between the structures leading to the new Parliament House.

Capital Circle Tunnel

Designing the Capital Circle Tunnel presented geometric complexities. It was to be located on a reverse curve where Capital Circle passed through an existing cutting. The structure required greater width than the roadway pavement in order to provide lateral sight distance clearance around the curve.

This led to a barrel-vaulted shape solution, with the footpaths at the springing lines of the arch allowing adequate sight distance. The tunnel pavement rotates to provide super-elevation from three per cent in one direction to three per cent in the other direction. The rotation was achieved by rotating the whole tunnel cross-section, thus allowing a constant roof cross-section to be adopted for ease of construction. The resulting geometry was complex yet the easy-to-build section provides clean-flowing, aesthetically pleasing lines.

The tunnel is 156 metres long between the large reinforced concrete portals. The finish and joint pattern on the portals was selected after lengthy consultation with the Architects and with tunnel lighting designers. The portals

have a textured concrete finish in keeping with the rest of the Parliament House complex, yet with an intensity of colour which ensures economical lighting in the tunnel by reducing the contrast between external and internal lighting levels.

The barrel-vault design is effectively a tied arch with the roadway slab forming the tension tie. Options of a prestressed and reinforced concrete pavement were considered; however, there was little cost differential and faster construction was possible with a reinforced pavement. The arch of the tunnel is connected to the portal walls via a ring beam which offers stiffness to the portals and the arch, and provides the architectural detail around the tunnel entry and exit.

The tunnel is constructed over two different rock strata. At the three-quarter point of the tunnel, near the western portal, a dipping fault line traverses the tunnel cross-section, skewed to the longitudinal axis of the tunnel. On either side of the fault the rock has different strength and stiffness. East of the fault the rock allowable bearing pressure is 270 kPa and stiffness (expressed as a modulus of subgrade reaction) is 50 kPa/mm. West of the fault the rock is the hard Black Mountain sandstone, which was attributed as allowing bearing pressure of 400 kPa and a stiffness of 5,000 to 25,000 kPa/mm.

The variation in rock stiffness presented problems for the tunnel cross-section, with greater stresses being induced by the differential settlement effects. Some thought was given to articulating the tunnel at the fault to cater for the anticipated differential movements. However, this would have created problems with waterproofing the structure and with the internal treatment of the articulation. Therefore, it was decided to strengthen the tunnel cross-section at the fault line, which simplified the solution and enabled the interior of the tunnel to maintain a constant appearance.

The effect of the fault was firstly confined to a right angle crossing by excavating soft rock and backfilling with mass concrete to "square-up" the interface between soft and hard foundations. The tunnel section straddling the fault was then thickened and post-tensioned longitudinally. This provided sufficient strength to resist the anticipated differential settlement effects, which would be magnified by the weight of the filling placed over the tunnel. During construction the thickened section was initially isolated from the standard sections to the east and west and later connected, with a 2 metre closing pour, as the final stage in the tunnel's construction. The tunnel construction proceeded from the eastern end to allow the casting on soft rock to precede the casting on hard rock, which maximised the amount of differential settlement that occurred prior to the casting of the closing pours.

The effects of differential temperature and different progressive levels of backfilling (the material coming from Camp Hill) during construction were analysed in the design. This led to the specification of a maximum differential in backfilling heights of 2 metres from one side of the tunnel to the other.

The flowing curvilinear lines of the tunnel are accentuated by two lines of lighting, the intensity of which varies through the tunnel. A high intensity of light is provided in the entry portal, reducing along the tunnel as the driver's eyes adjust to the lower light levels.

The tunnel has automatic sprinklers, fire hydrants, hose reels and warning devices linked to the ACT Fire Brigade network. Axial flow fans, activated by carbon monoxide monitors, operate should there be a buildup in carbon monoxide in the tunnel.

Given the closeness of the tunnel to the new Parliament

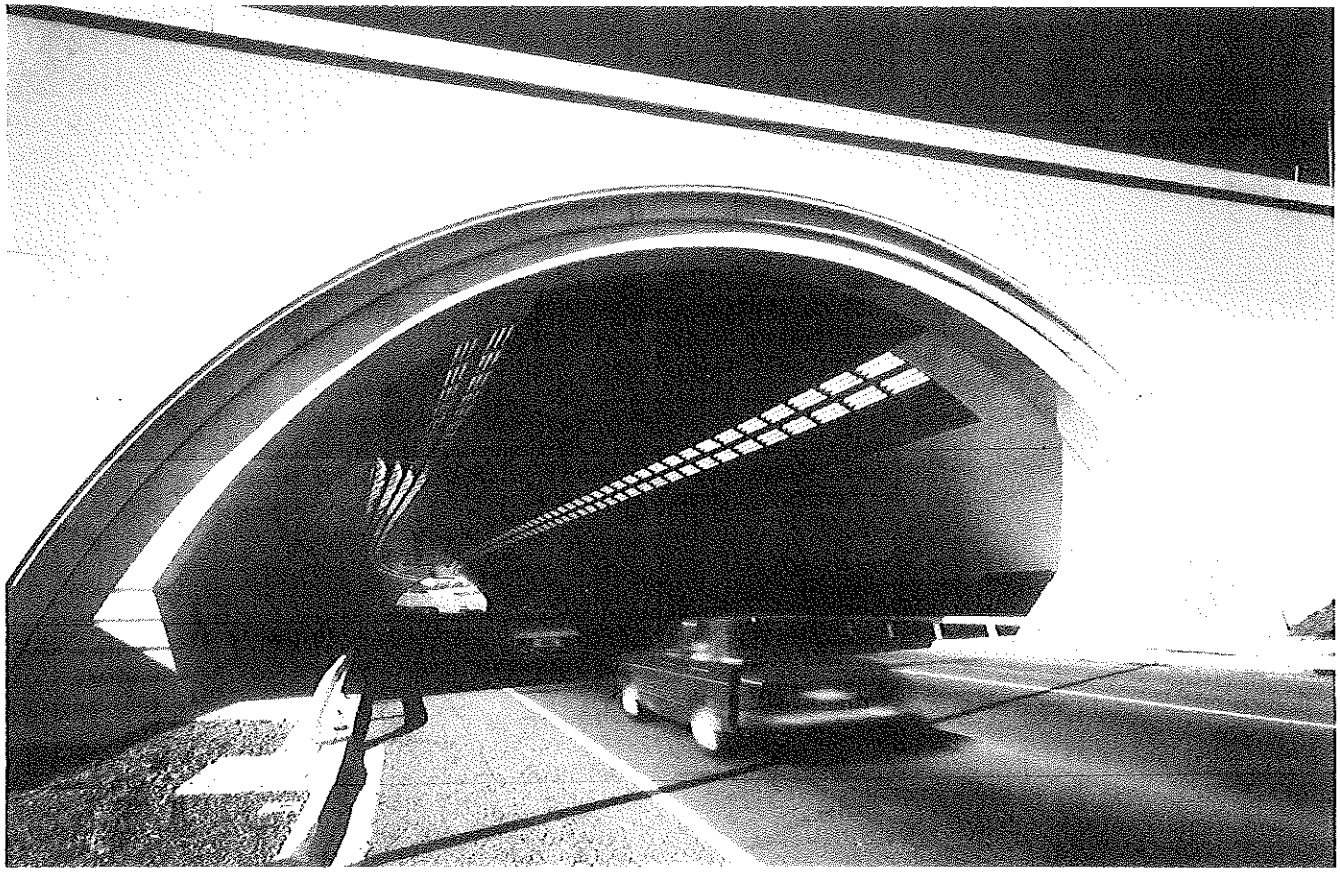


Fig. 14.9: Capital Circle tunnel western portal.

House, a closed circuit television surveillance system allows constant police monitoring of the tunnel.

All services within the tunnel are concealed within the haunches at the arch springing lines, giving the tunnel a clear flowing appearance which is emphasised by the strip steel lining covering the curved arch. The lining has a red-brick colour between the rows of lighting, and an acoustic backing to minimise traffic noise.

Geologically Significant Rock Cutting

State Circle passes under the Land Axis in an existing cutting through Camp Hill sandstone rock. The rock cutting exposes a geologically significant rock profile which had to be retained and protected from deterioration during the construction.

The Land Axis roads are carried over State Circle on bridges which have their northern abutments set back from the face of the cutting and are founded at a level above a berm which provides a top edge termination to the rock face.

The stability of this rock face was investigated and drainage works were designed to prevent surface water flowing over it and to minimise seepage and ground water pressure behind the face. During construction care was taken to protect the face from damage and the extent of remodelling of the land contours during the removal of part of Camp Hill was the subject of discussions with the Geological Society of the ACT, to ensure that the rock face remained intact.

A viewing platform has been constructed on the south side of State Circle between the two Land Axis bridges, to provide for formal viewing of the rock face.

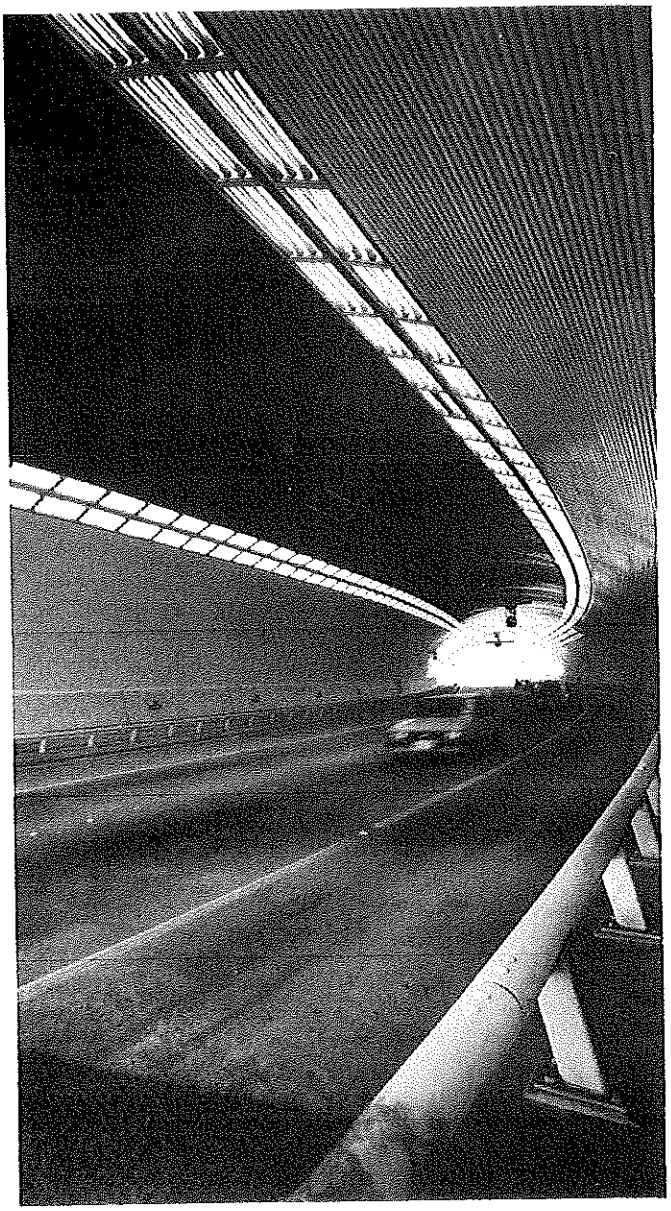


Fig. 14.10: The clean lines of Capital Circle tunnel.

Commencement Column Monument

On the original Capital Hill site a Commencement Column Monument was officially laid, commemorating the naming of Canberra as the Federal Capital.

The column comprised 63 stones with three foundation stones, one each laid by the then Prime Minister, the Hon Andrew Fisher; Sir Thomas Denman, Baron and Governor General and Commander in Chief of the Commonwealth of Australia; and the Hon King O'Malley, Minister of State for Home Affairs at the time.

The naming ceremony took place on 12 March 1913, 75 years to the day prior to the monument's relocation on the Land Axis, and it was at the original ceremony that Lady Denman named the Federal Capital Canberra.

The ceremony to officially relocate the monument from its original site to its new site near the forecourt of the new Parliament House was attended by the modern day counterparts of the original participants, namely the Hon R.J. Hawke, Sir Ninian Stephen and the Hon Gary Punch, M.P.

The relocation of the monument was one of the finishing tasks in the access roads project, completed several months prior to the opening of the new Parliament House.

Peripheral Works

The construction of the roads and bridges to the new House provided an opportunity to upgrade some adjoining areas, to link them in with the complex. Areas upgraded included:

- *The Lodge retarding basin.* The open area adjacent to The Lodge was contoured, regrassed and planted with additional trees. The shaping of the area formed a small retarding basin to contain overland runoff.
- *Modifications to Adelaide Avenue bridge.* Minor changes to the Adelaide Avenue alignment required kerb and barrier rail modifications.
- *Scrivener's Hut.* The original hut used by Scrivener during his survey for the National Capital site is located within the annulus formed by State Circle. Landscaping works, including a new cycle path, have upgraded this area, and the hut is now adjacent to a public recreation area.

Construction

Construction of the works was carried out in five main contracts, between 1983 and 1989, with all works substantially completed for the official opening in May 1988.

The timing and size of the five packages of work were adjusted to suit the traffic requirements of the site and cash flow constraints. The main packages were, in chronological order:

- *Southern Roadworks Package.* These works concentrated on roadworks required at the southern end of the site and involved widening and lowering Capital Circle between Canberra and Adelaide Avenues. Also constructed was the Melbourne Avenue link towards Capital Hill and modifications along Adelaide Avenue.

- *Bridges Package.* This was principally a bridgeworks contract with the construction of the two Land Axis bridges over State Circle and the construction of the Melbourne Avenue bridge.
- *Commonwealth Avenue North Package.* This contract included all works on Commonwealth Avenue north of Coronation Drive. It involved the reconstruction of the Coronation Drive-Commonwealth Avenue intersection and all the other minor road and drainage works in the area.
- *Commonwealth Avenue Extension Package.* This was the second largest package of work and involved construction of the new central bridge and ramp structures up the centre of Commonwealth Avenue, onto Capital Hill.
- *Tunnel Package.* The Capital Circle tunnel was constructed in this, the largest of the contracts. Under these works, the Land Axis was formed, together with its landscape. The Kings Avenue link was also established in this package, with the construction of the Kings Avenue/State Circle intersection and the building of a new bridge over

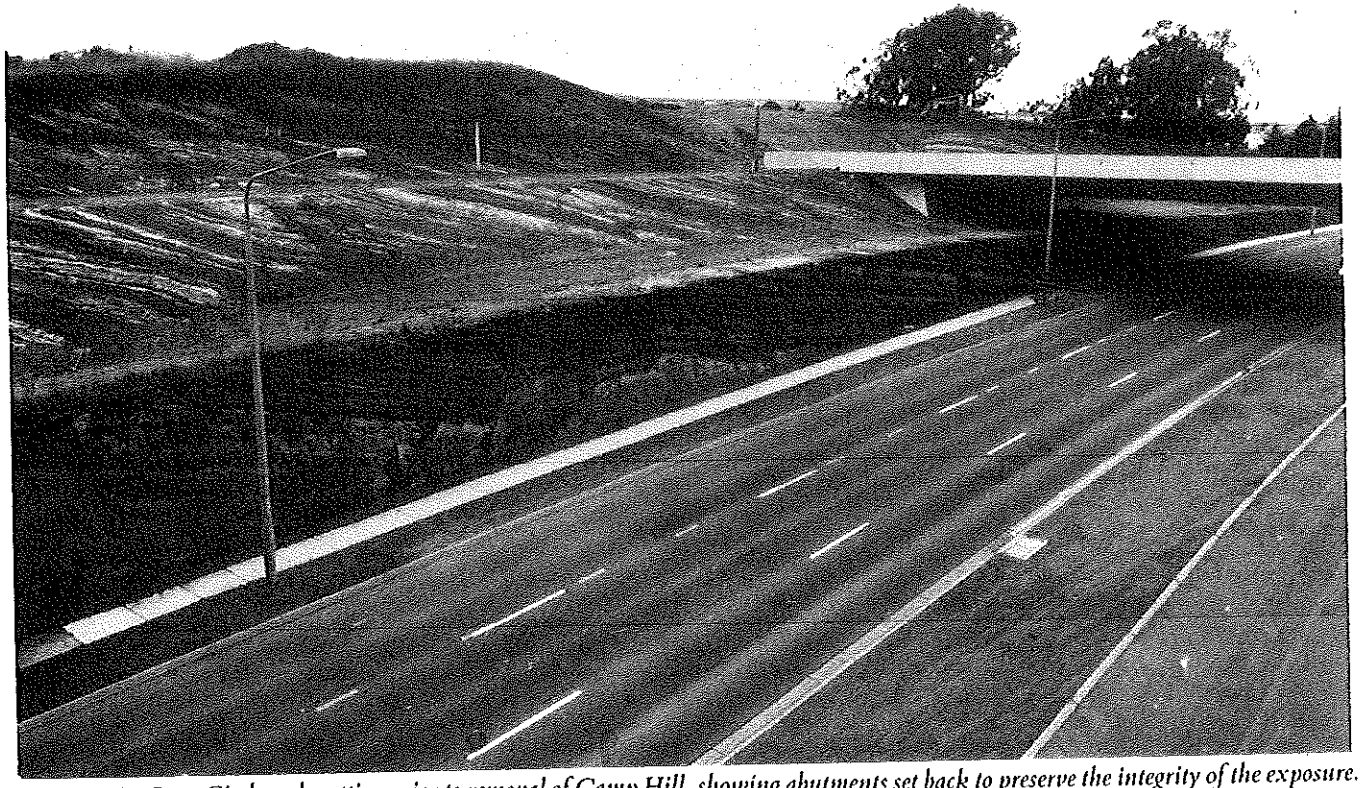


Fig. 14.11: State Circle rock cutting prior to removal of Camp Hill, showing abutments set back to preserve the integrity of the exposure. Source: NCDC.

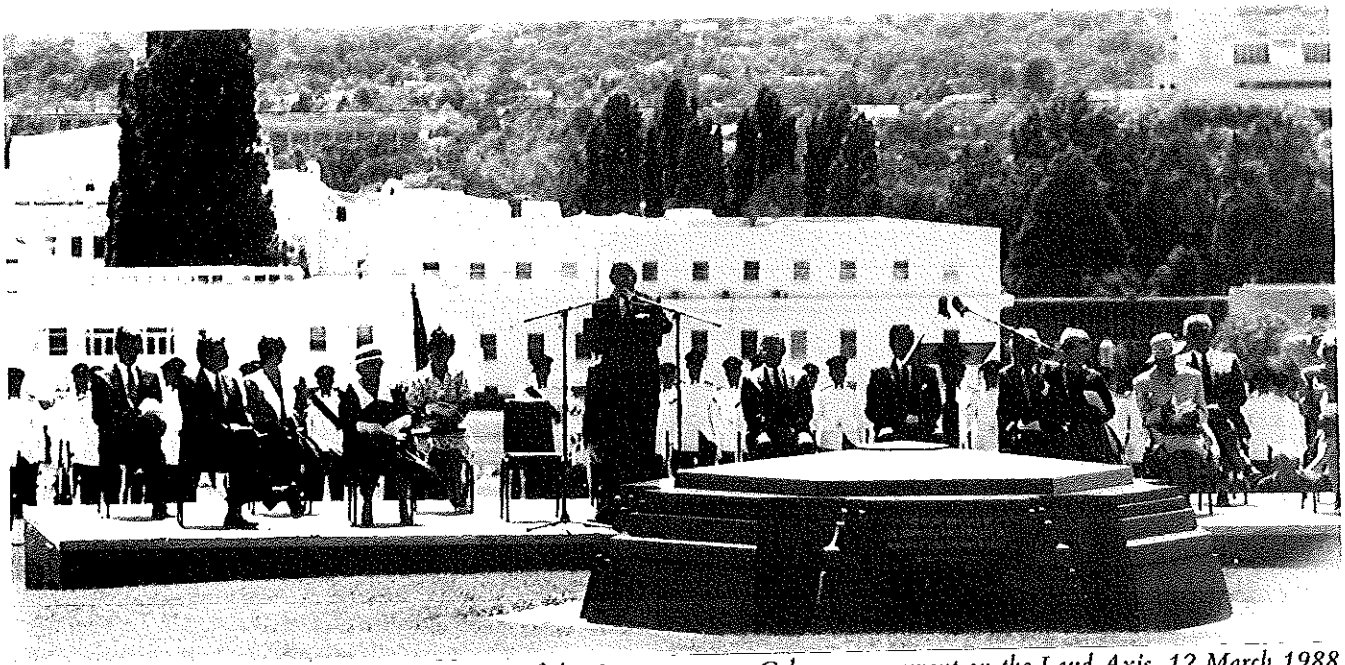


Fig. 14.12: Ceremony marking the repositioning of the Commencement Column monument on the Land Axis, 12 March 1988.

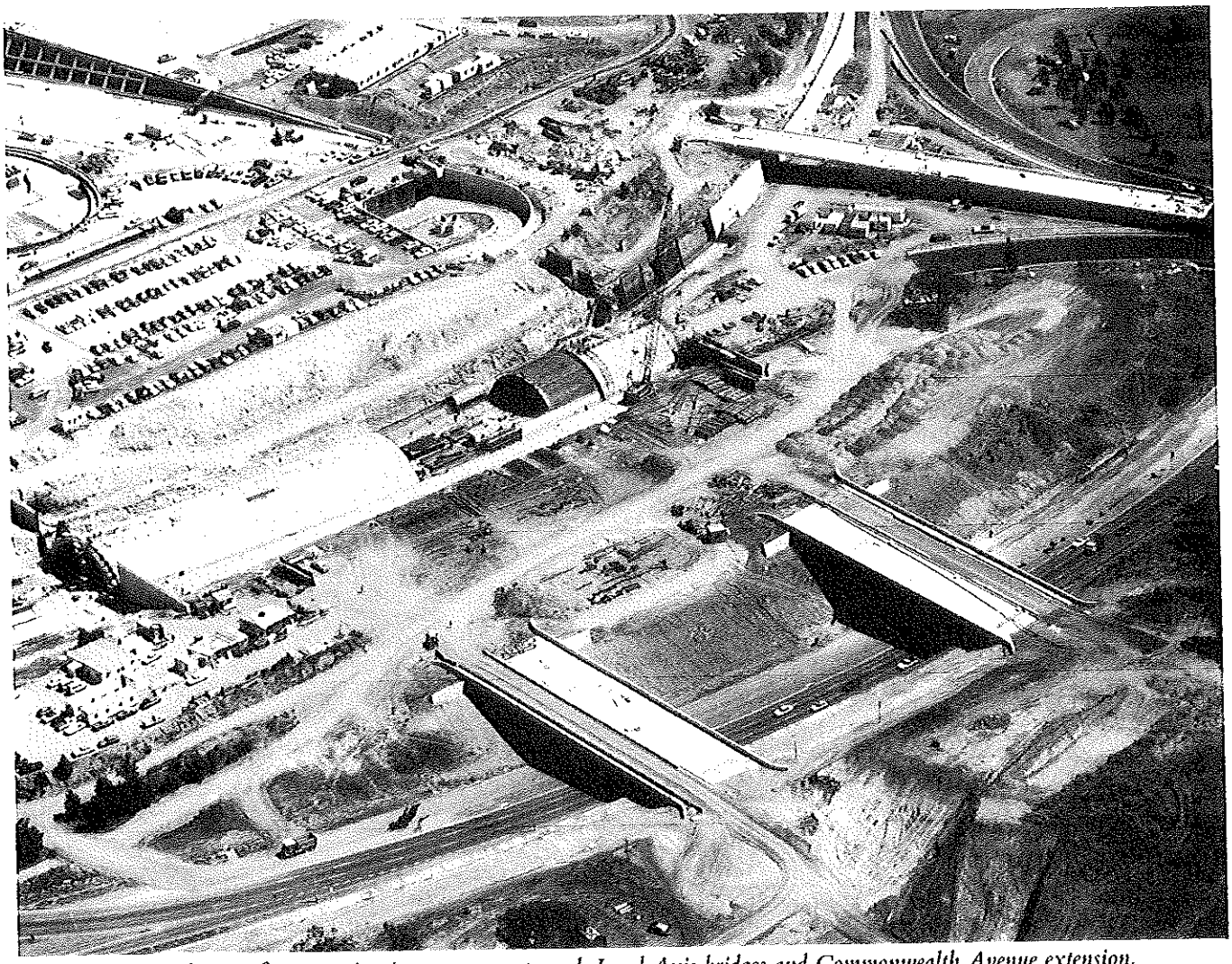


Fig. 14.13: Aerial view of construction in progress on tunnel, Land Axis bridges and Commonwealth Avenue extension.

Capital Circle. This package of work substantially completed the Parliament House access roads works.

The construction works involved some complex programming and timing issues; however, the construction of the works themselves involved no new or different construction techniques. The quality of finish was achieved by the application of good control over traditional construction methods. All work was completed to schedule and the initial estimates proved to be accurate, allowing for the effects of inflation in the intervening years.

Acknowledgements

This chapter draws heavily on the various reports and documents produced by design agents, Maunsell & Partners, in the process of design development and during their management of its construction.

The project was a major team effort with the authors part of that team which comprised not only NCDC and PHCA staff but also the many other consultants who worked on the project.

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ATTACHMENT G

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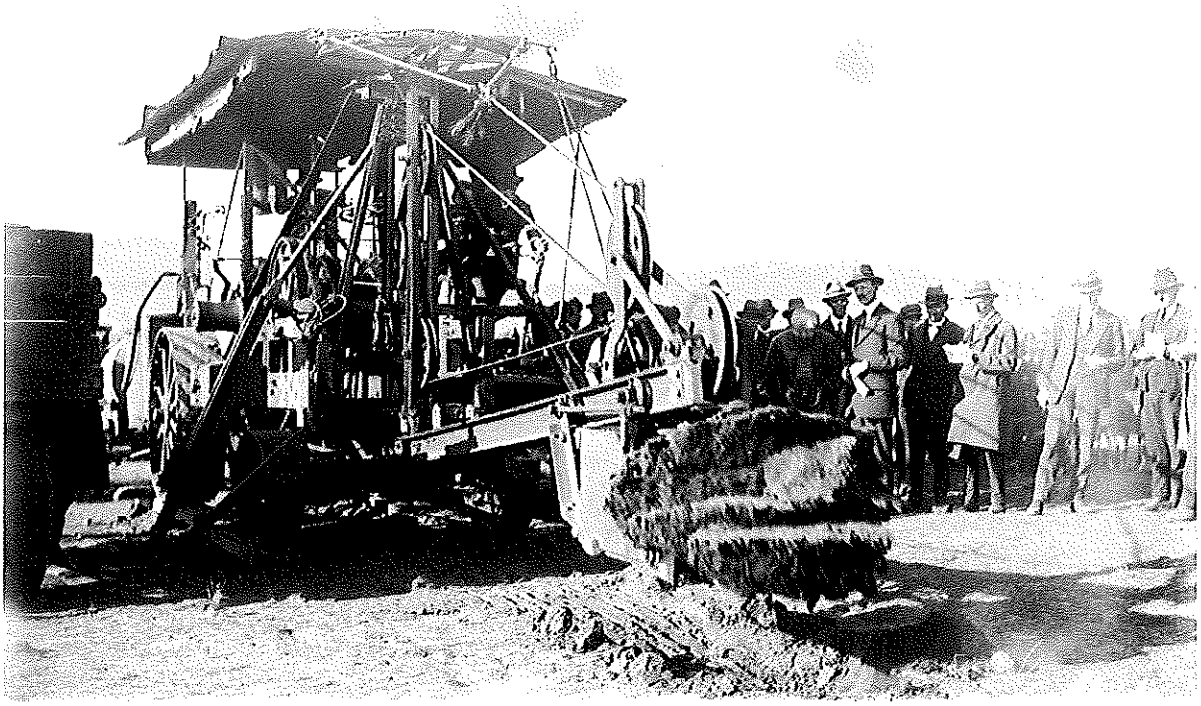
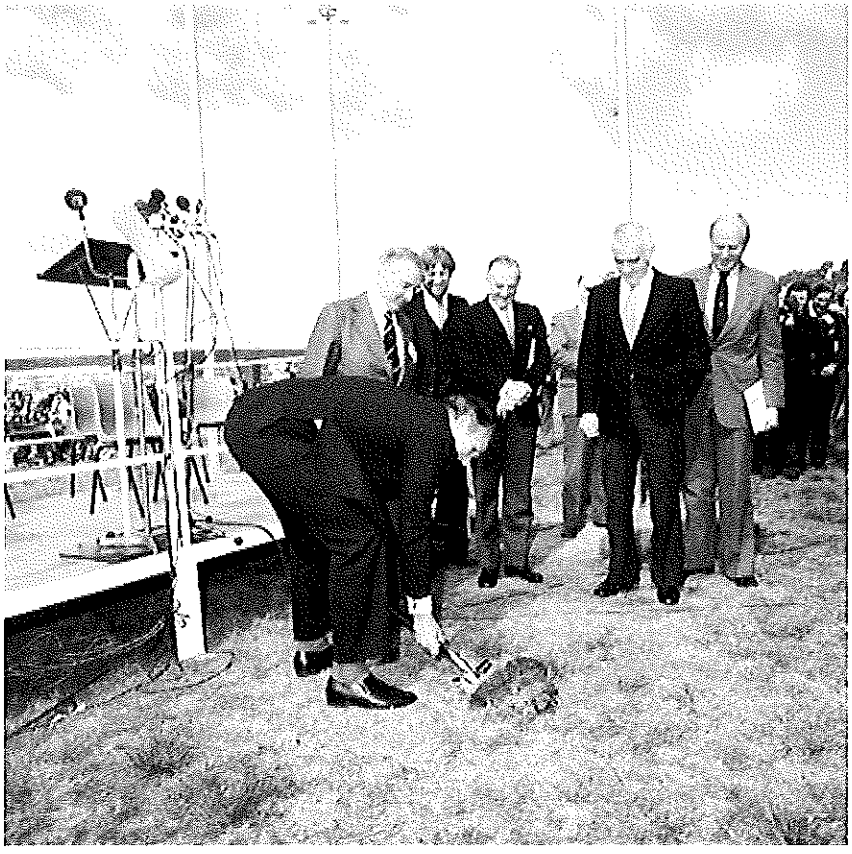
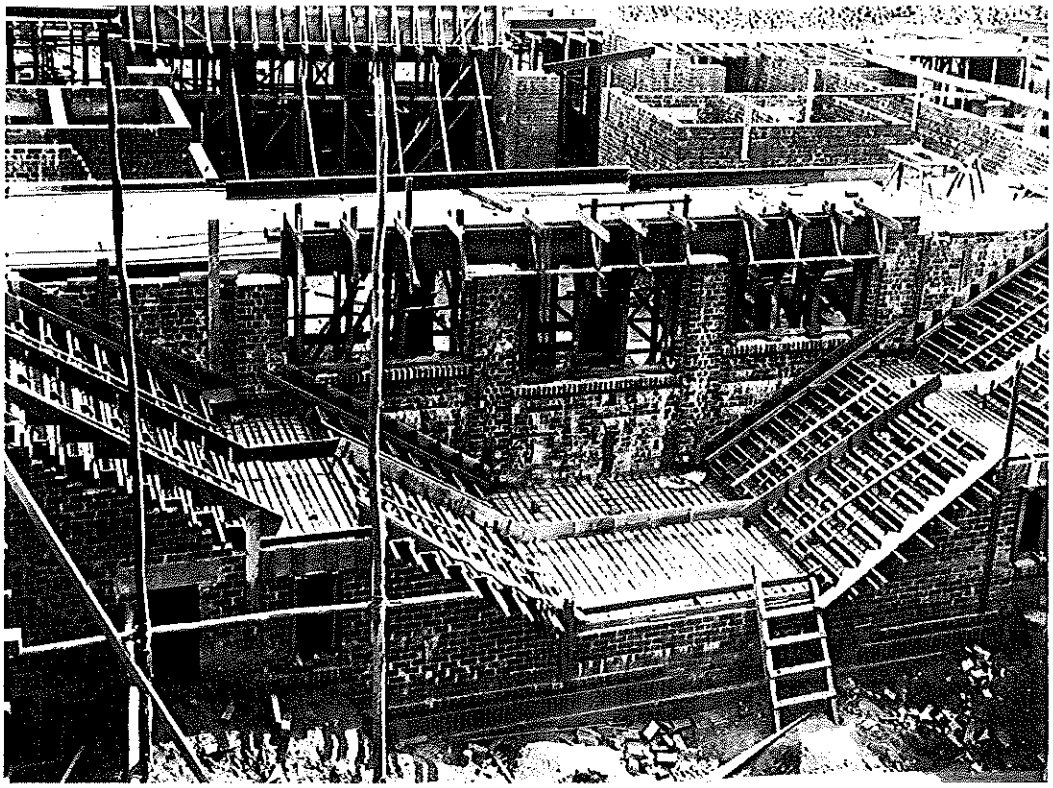


Minister for Works and Railways Percy Stewart turns the first sod for the construction of the provisional Parliament House, with a Keystone steam shovel driven by Joe Lea – 1 January 1923.

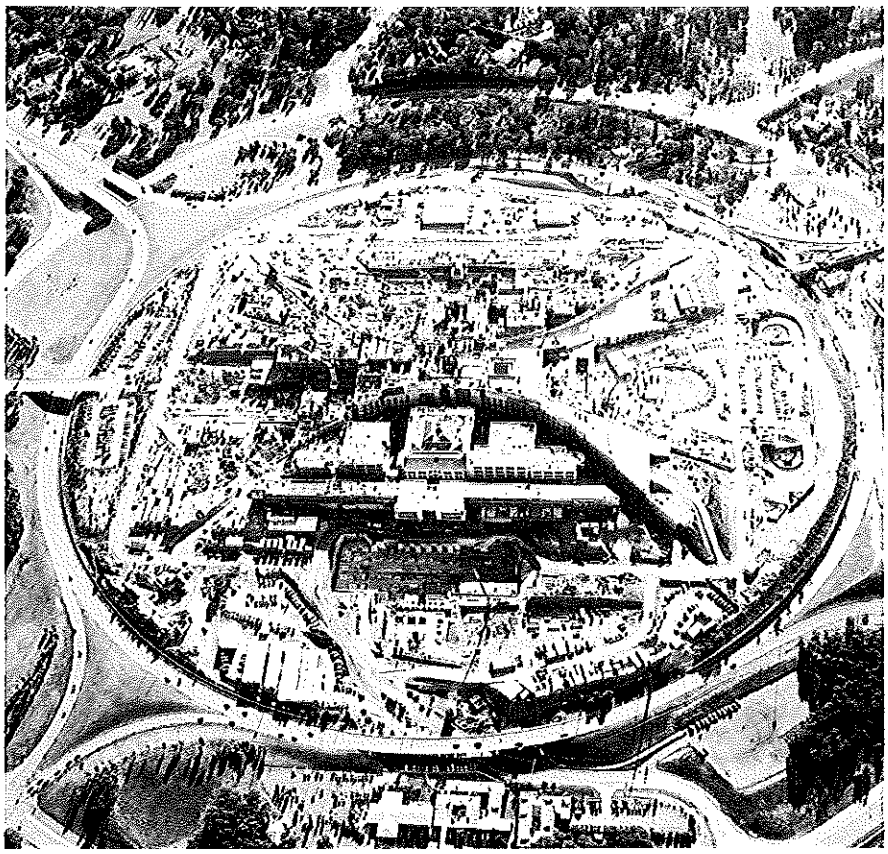


Less generously equipped Prime Minister Malcolm Fraser turns the first sod for the construction of the new Parliament House – 1980.

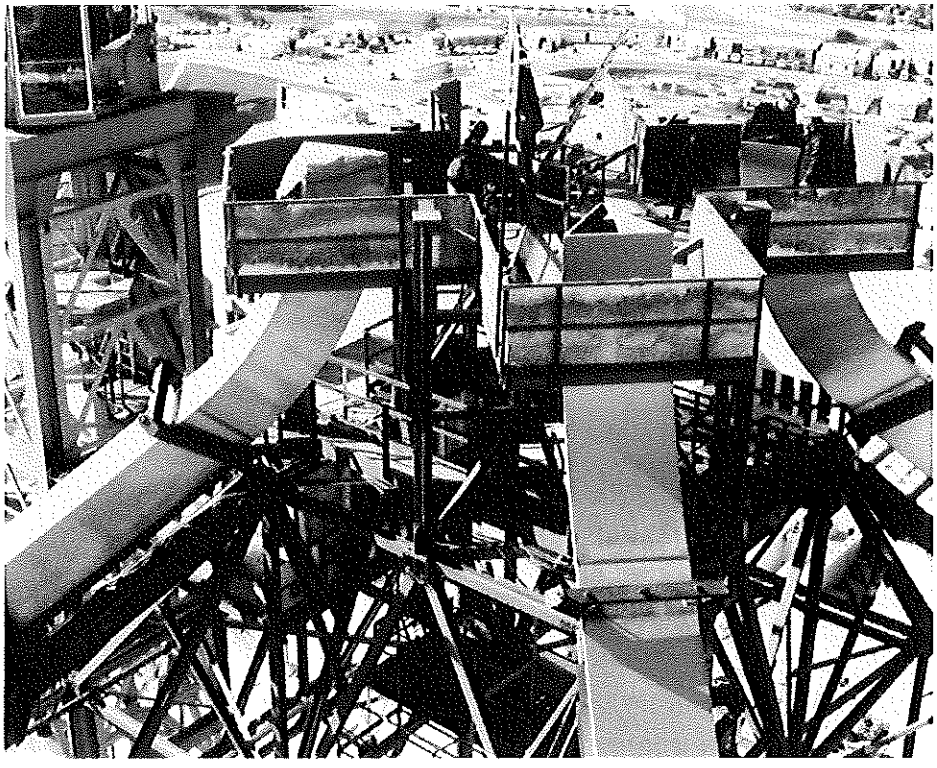


The provisional Parliament House under construction – 1925.

Provisional Parliament House landscape development with horse teams.



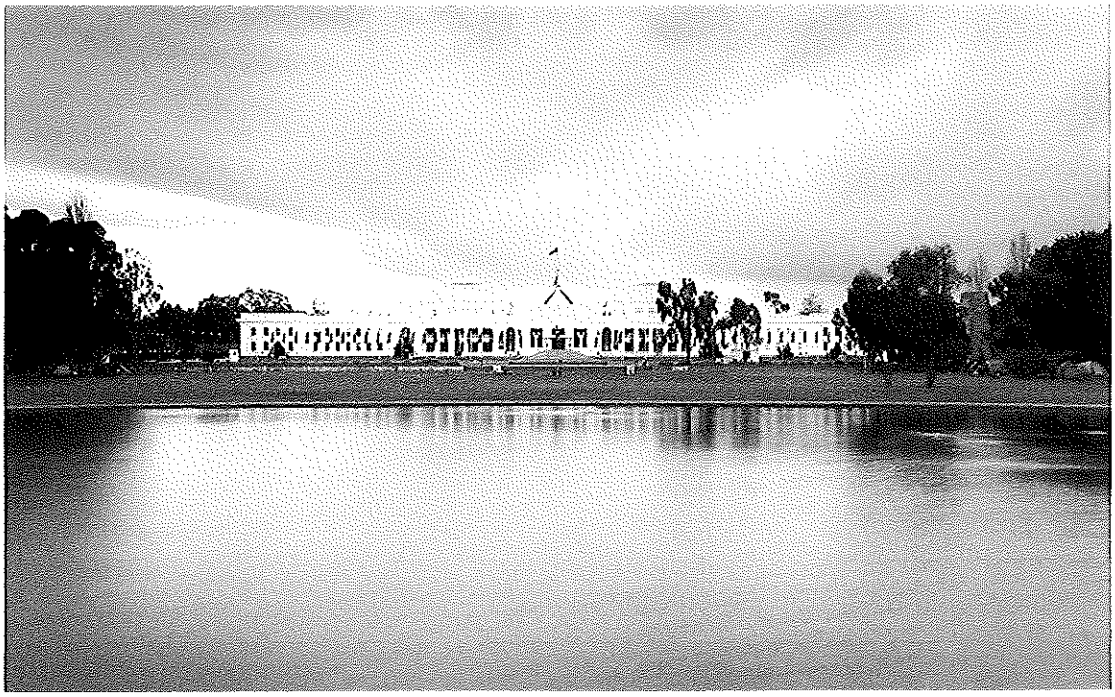
Aerial view of new Parliament House under construction in 1985.



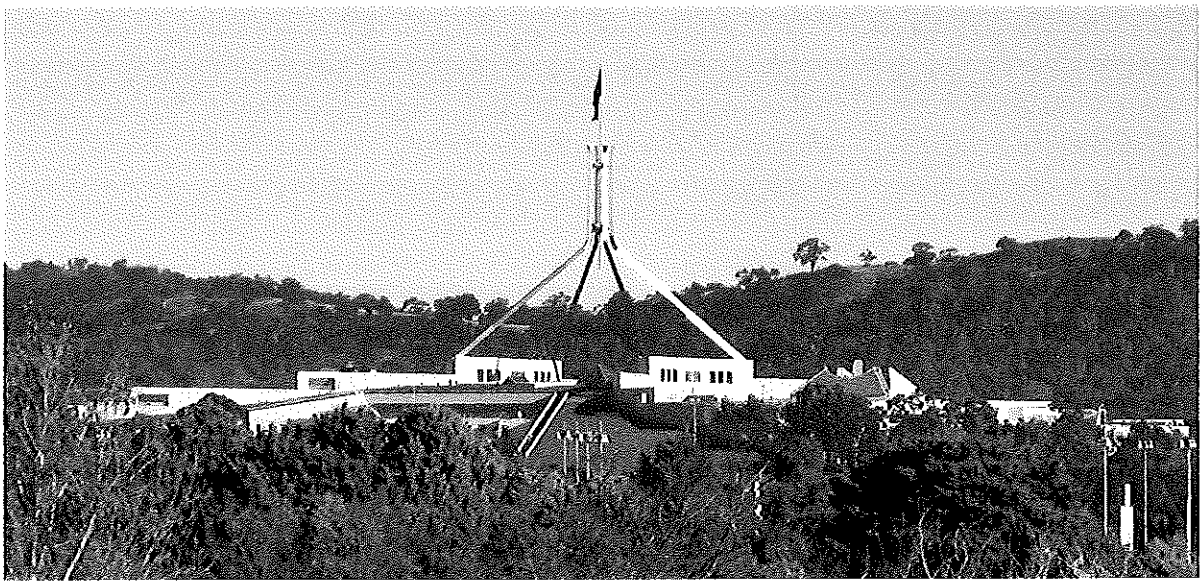
Flagpole construction – working platform on scaffolded tower legs.

The Duke of York opens the Provisional Parliament House - 9 May 1927.

HRH Queen Elizabeth II opens the new Parliament House – 9 May 1988.



A recent image of Old Parliament House



New Parliament House in 2012.

ATTACHMENT H

SAMPLE TEXT FOR AN INTERPRETIVE PANEL

Discussion

The question of an interpretive panel for this dual nomination raises a number of issues:

- the importance and detail of each parliament house renders the standard 600mm X 900mm panel inadequate for both houses; each demands that space for itself;
- the special and "hallowed" nature of the chosen site – Federation Mall between the two houses – will require a structure appropriate for the national significance of the place and will be required by the two other major players, the National Capital Authority and the Department of Parliamentary Services.

There appear to be three options for the interpretive panel structure:

- a standard 600mm X 900mm panel mounted on a lean-back frame as used for the Main Outfall Sewer panel and widely around Canberra and elsewhere;
- a double sided structure with two standard panels, one facing up the hill towards Parliament House and the other facing down the hill towards Old Parliament House; and
- a unique structure still to be defined perhaps incorporated into existing features such as the curb, a corner or other element of the Mall acceptable to the other parties.

As stated earlier the first option is considered inadequate. For the purposes of this document the following overviews of the envisaged panel layout, assumes each House will have 600mm X 900mm of space allocated to it.

Old Parliament House

Historic image of the building.

The opening section would contain details of Federation, the selection of Canberra as the site of the National Capital and the naming of the capital.

The second section may contain information on the effect of World War I on parliament house progress, the aborted design competition and the decision to build a provisional house designed by J S Murdoch.

The next paragraph might include information on the construction phase leading up to the opening by the Duke of York in 1927. Topics could include the Federal Capital Commission, Sir John Butters and other significant persons.

The next section could address the history of the House since its opening, the Prime ministers and their governments, the Great Depression, the war years, and significant events.

The last section should include the latter stages of its use when its inadequacy for its purpose became increasingly apparent and the decision to replace it was made.

Images will be chosen from the wide selection available to cover the inauguration and construction, opening, use, major events such as the Dismissal and current employment as a Museum of Democracy.

----------ooOoo----------

New Parliament House

Image of the new Parliament House

As with OPH the first section will describe events leading up to the decision to replace the provisional facility with a structure designed to last 200 years. It should briefly describe the action to establish the Parliament House Construction Authority which worked in liason with the National Capital Construction Authority, the Department of Housing and Construction and other associations.

The second section will cover the construction both of the house and surrounding bridge and road works. Details of the number of workers, soil excavated, concrete consumed, flag mast structure, costs and similar statistics may be included to provide the reader with some of the nature of this mammoth task.

The next section could deal with completion of the complex, its timing and final cost (said to be the most expensive individual building in the world at the time) and its opening by Queen Elizabeth II on 9 May 1988.

Finally some comment could be made on the nature of the building after 25 years, its effectiveness and its place in the national Capital and the hearts of the citizens.

Again images illustrating the matters referred to in the text will be chosen from the large stock available.

----------ooOoo----------

It is expected the contents of both panels will draw heavily on the recently launched book *A Century of Canberra Engineering* by well known local engineer/historian Keith Baker.

It may be appropriate to include, along with the necessary Engineering Heritage Recognition Program images, a statement that the panels were unveiled in 2013 as part of the 17th National Engineering Heritage Conference held as part of the celebrations of the centenary of the naming of Canberra as the National Capital.

----------ooOoo----------